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L OFFICIAL PLAN 1970
THE CITY OF HAMILTON
RAPID TRANSIT

(TRANSPORTATION:
DIVISION ONE)

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CITY OF HAMILTON
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GENERAL PLAN

PART TWO

DRAFT OFFICIAL PLAN 1970 OF THE CITY OF

HAMILTON

FIRST DIVISION

RAPID TRANSIT

of the

SECOND ARTICLE

TRANSPORTATION

CITY OF HAMILTON PLANNING DEPARTMENT

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CONTENTS

SECTION ONE

BASIS OF PLANNING

Subsection 1.1	INTRODUCTION	3
Subsection 1.2	OBJECTIVES AND PRINCIPLES	10
Subsection 1.3	ALTERNATIVE PATTERNS	15
Subsection 1.4	CORRIDOR ALIGNMENTS	24
Subsection 1.5	CENTRAL BUSINESS DISTRICT TRANSIT SCHEMES	34
Subsection 1.6	INTEGRATION AND DEVELOPMENT. . .	44
Subsection 1.7	PHYSICAL CHARACTERISTIC AND PHASING	53
Subsection 1.8	DESCRIPTION OF SCHEDULES	60

SECTION TWO

POLICIES

Subsection 2.1	GENERAL	63
Subsection 2.2	POLICIES	64

SECTION THREE

IMPLEMENTATION

Subsection 3.1	GENERAL	70
Subsection 3.2	IMPLEMENTATION	71
Subsection 3.3	PROCEDURE	73
Subsection 3.4	PLAN ADOPTION	76
Subsection 3.5	DESCRIPTION OF SCHEDULES . . .	77

APPENDIX

THE CONCEPT OF ACCESSIBILITY	82
METROPOLITAN TRANSPORT PATTERNS	89
RAPID TRANSIT IN OTHER CANADIAN CITIES	91

LIST OF SCHEDULES

SECTION ONE

1-P	Five Principles of Geometric Configuration . . .	14
1-Q	Alternative Patterns	23
1-R1	Burlington Corridor	29
1-R2	West Mountain Corridor	30
1-R3	East Mountain Corridor	31
1-R4	Lower Hamilton Corridor	32
1-R5	Dundas Corridor	33
1-S1	C.B.D. Transit Scheme 1	38
1-S2	C.B.D. Transit Scheme 2	39
1-S3	C.B.D. Transit Scheme 3	40
1-S4	C.B.D. Transit Scheme 4	41
1-S5	C.B.D. Transit Scheme 5	42
1-S6	C.B.D. Transit Scheme 6	43
1-T1	Integration and Development: Proposal A	50
1-T2	Integration and Development: Proposal B	51
1-T3	Integration and Development: Proposal C	52

SECTION TWO

2-U	Rapid Transit Policies	65
-----	----------------------------------	----

SECTION THREE

3-V	Accessibility as a Tool of Implementation.	69
3-W	Focus Alternatives	78

TABLES

Table 1.1	Costs of Construction	58
Table 1.2	Operating Speeds	59
Table A.1	Normal Relative Accessibility Tables . . .	108
Table A.2	Normal Integral Accessibility Tables . . .	109

LIST OF FIGURES

Key Plan of Schedules	iii
Figure 1.1 Topographical Features of Six Major Canadian Cities	5
Figure 1.2 Population Accessibility Spectrum	9
Figure 1.3 Elevations of Rapid Transit	55
Figure A.1 Concept of Relative Accessibility	87
Figure A.2 Concept of Integral Accessibility	88
Figure A.3 Metropolitan Transport Patterns	90
Figure A.4 Rapid Transit Pattern Proposals: Calgary and Edmonton	97
Figure A.5 Rapid Transit: Toronto	98
Figure A.6 Proposed Rapid Transit : Winnipeg	105
Employment Density Distribution: Downtown Area	115
Manufacturing and C.B.D. Employment Density Map	116
Population Density Map	117

SECTION ONE

BASIS OF PLANNING

A general statement of Planning principles upon which the policies of the Official Plan are based.

Subsection 1.1

INTRODUCTION

Hamilton, with a metropolitan population in 1969 of approximately 480,000, is the sixth largest city in Canada and the third largest city of Ontario, trailing Ottawa-Hull by a slim margin. It is perhaps the greatest centre of secondary manufacturing in the country, a vital contributor to the national economy. Any job that casts a future eye upon the welfare and development of so prestigious a city, as most certainly does the planning of rapid transit, cannot help but be a rewarding task. (1.1.1)

Rewarding as well, in the case of Hamilton, insofar as it involves challenge. (1.1.2)

In a Canadian metropolitan context, only the City of Quebec approaches Hamilton in being handicapped, if you will, strictly from the transportation point of view, by natural physical features which render the planning of rapid transit (and other travel means) at best a difficult contention. (1.1.3)

It is most interesting, and enlightening, to compare the topographical problems of our major Canadian cities, or perhaps, more meaningfully, of those cities without existing rapid transit facilities and of a size similar to that of Hamilton. We will thus forego discussion of Montreal, Toronto, and Vancouver, whose scales create complexities with which it would be difficult to relate Hamilton's own environment. The cities which we will consider are Winnipeg, Ottawa, Quebec, Edmonton and Calgary, in order of descending metro population. The simplified illustrations in Figure 1.1 represent the dominant physical features of each of these five cities and of Hamilton. (1.1.4)

The prairie cities are the least difficult to plan for, being built on generally even landscapes. The only natural physical impediments to direct transit routing are the rivers upon which such cities sprung up. Rapid transit fords may be effected with little

difficulty across such rivers as the Red and Assiniboine in Winnipeg, the Bow and Elbow in Calgary, and the Saskatchewan through Edmonton. Some comments and details on the proposed rapid transit scheme of Calgary and Edmonton may be found in the Appendix. (1.1.5)

A more complicated environment exists in the Ottawa-Hull metropolitan area, at the confluence of the Gatineau, Rideau, and Ottawa Rivers. Not only is the Ottawa River broad, but its banks are steep and high. These factors will give some pause to the planning engineers who must provide a direct transit link between the city centres of Hull and Ottawa. (1.1.6)

A somewhat parallel situation occurs at Quebec, but to a greater extreme. The cities of Quebec and Levy are situated on opposite sides of the St. Lawrence River. However, the St. Lawrence is at least 3/4 of a mile wide and its banks are not "steep"--they are virtual cliffs, 300 feet high. (1.1.7)

For the navigable waterways, sufficient head room or channel depth must be maintained to permit the continuance of vessel activities. Any component of the Seaway System, such as the St. Lawrence or any of the Great Lakes, requires vertical clearances in the order of 120 feet overhead and 50 feet below water level. The Ottawa and Rideau Rivers, both well-used shipping channels but for smaller craft, should maintain clearances of 40 and 30 feet, above and below water level respectively. The Red and Assiniboine ought to require these clearances as well, but may and have gotten away with less, since navigation is generally restricted to small pleasure craft. The Bow and Saskatchewan Rivers are even less of a concern with regard to vessel clearances. (1.1.8)

In Hamilton, we find a combination and ultimatum of all the foregoing features. (1.1.9)

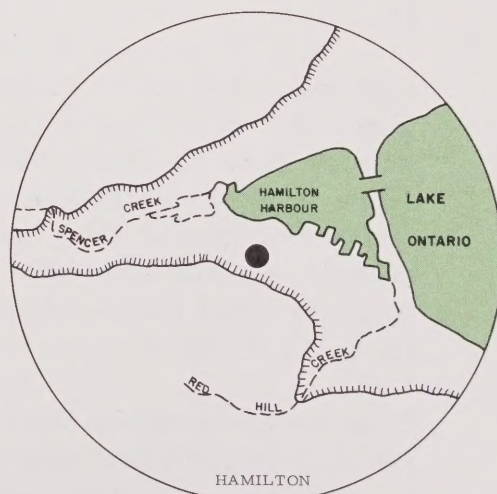
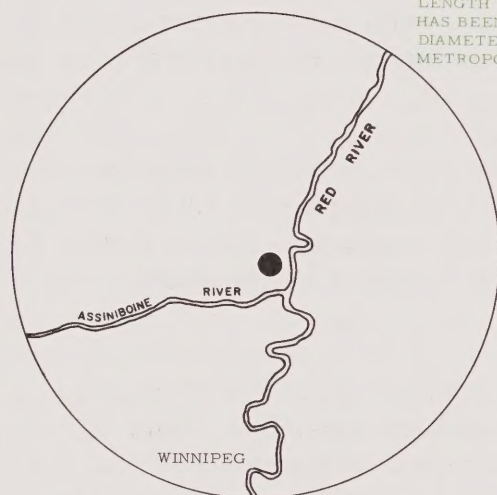
Intensive development in the area is wrapped around the western tip of Lake Ontario: Hamilton to the south; Dundas to the west; Burlington, Aldershot, and Waterdown to the north. Hamilton Harbour thus acts as a massive barrier (up to four miles across) to direct communication between the Hamilton and Burlington central areas. (1.1.10)

TOPOGRAPHICAL FEATURES

SIX MAJOR CANADIAN CITIES



BECAUSE THE ACCESSIBILITIES GENERATED BY A RAPID TRANSIT LINE BECOME BENEFICIAL ONLY AFTER A MINIMUM DIAMETER LENGTH OF 14 MILES, THIS LENGTH HAS BEEN CHOSEN HERE AS THE DIAMETER OF THE ILLUSTRATED METROPOLITAN AREAS.



LEGEND

- STEEP SLOPE [hatched pattern]
- CLIFF OR ESCARPMENT [hatched pattern]
- WATERWAY NAVIGABLE BY SEA-GOING VESSEL [green box]
- OTHER MINOR RIVER [dashed line]
- CITY CENTRE [black dot]

Even the use of the Beach Strip, a devious route requiring twice the direct distance between downtown Hamilton and Burlington, requires the clearance of the harbour inlet channel, that is, 120 feet above or 40 feet below mean water level. (1.1.11)

The steep, 360 foot Niagara Escarpment circles around the end of the lake, imposing itself between the extensive and expanding residential area on top of the "Mountain" and the dominant industrial and commercial concentrations below the cliff face. The Escarpment also isolates the communities of Salfleet, Ancaster and Waterdown from the dense lowland development adjacent to Hamilton Harbour. (1.1.12)

Lastly, the stream valleys of Red Hill Creek and Spencer Creek must be crossed if adequately extensive rapid transit service is to be provided. (1.1.13)

Bearing these difficulties in mind, however, one fact remains. Some sort of organized consideration to rapid transit must be given, at this time, on which to base the land use studies and other components which are part of the Draft Official Plan. (1.1.14)

We present herein a selection of alternative networks of rapid transit to serve the City of Hamilton and its suburbs. This is not to say that these are the only alternatives possible; indeed, the number is limitless. Rather, they are those networks which best illustrate the principles of sound urban development. Furthermore, an effort has been made to indicate not only "what to strive for" but also "what to strive against". (1.1.15)

For the purposes of the Draft Official Plan, we shall accept as probable the supposition, considering the increasing urban growth rates in Southern Ontario, that the City of Hamilton, at some point in the future, will require the transportation characteristics of high volume, speed, and efficiency which only future rapid transit can provide. The actual date when this need becomes of priority level will have to be determined in a subsequent study. (1.1.16)

Even today, though, the peak hour congestion of our auto-dominant transportation system is a tell-tale indicator of the impending need for grade separated transit. And at this very moment, public sentiment is urging City Council to investigate the possibility of rapid transit in Hamilton. (1.1.17)

Consultant J. Spiegelman, in a special paper to the First Canadian Urban Transportation Conference, made some particularly relevant remarks on the subject of rapid transit in Canadian municipalities. The following excerpts from his paper* constitute a brief but excellent introduction in themselves. (1.1.18)

- " The present character of a community and the desired future form of urban development and expansion are the two most important features governing how its transportation needs must be met. It is clear that, due to the diversified nature of transportation no one mode, automobile or the various forms of public transit, can adequately service an entire urban area. Rapid transit, in present day terminology, is a high capacity fixed route system with vehicles operating in grade separated, exclusive right of way. It is generally considered to operate within 15 miles of the city centre at an average speed of over 20 miles per hour, depending upon station spacing. Passenger station spacing varies from about three per mile in the central area to about one per mile in areas away from the city centre. Capacities range from about 15,000 to 60,000 passengers per track per hour past the peak load point. (1.1.19)
- " The matter of demand for rapid transit gives rise to the question frequently asked when urban municipalities are faced with serious traffic problems: "What size should the city be to warrant the operation of a rapid transit system?". There is no magic number which answers this question. (1.1.20)
- " An urban area with a population of one million has often been cited as sufficient to warrant rapid transit. Broadly considered, this was a good guide for cities whose development has followed the normal pattern. Exceptions to this rule are cities whose population densities, distributions and travel needs create sufficient demand to require rapid

* TECHNOLOGICAL DEVELOPMENTS AND URBAN TRANSPORTATION MASS TRANSIT TRUNK SYSTEMS,
a Study Paper by J. SPIEGELMAN,
prepared for the FIRST CANADIAN URBAN TRANSPORTATION CONFERENCE, February, 1969.

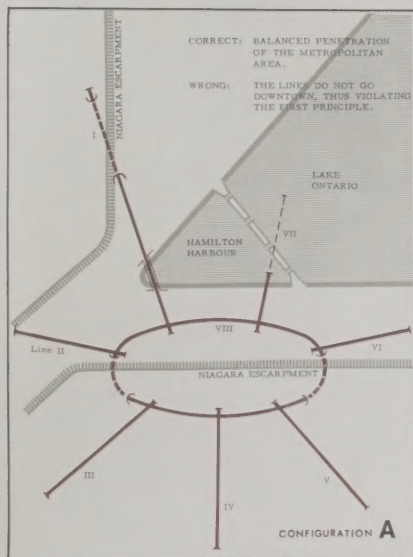
transit when the population reaches half that figure. Similarly, the population can reach two million in some cases and still not warrant a rapid transit line. More specifically, the demand for rapid transit is directly related to corridor travel volumes. (1.1.21)

" Surface transit in mixed traffic on a major arterial is limited to about 10,000 passengers per hour. When this corridor traffic volume is reached, it is virtually impossible to handle a greater number of passengers. At that volume, too, the quality of service is usually very poor with average speeds in the order of seven miles per hour. It is at this stage that rapid transit or other improvement to the transportation systems is required. (1.1.22)

" As early as 1910, rapid transit was envisaged for Toronto and Montreal whose populations at that time were 368,000 and 610,000 respectively. Recent [1961] population counts for other Canadian urban areas are:

Vancouver	790,000
Winnipeg	475,000
Ottawa - Hull	490,000
Hamilton	395,000
Quebec	357,000
Edmonton	337,000
Calgary	280,000

Since it takes several years of traffic studies and planning and at least five years from the start of detailed design to the inauguration of service, it is apparent that the current serious consideration of rapid transit for the above cities is not premature." (1.1.23)



FIRST PRINCIPLE

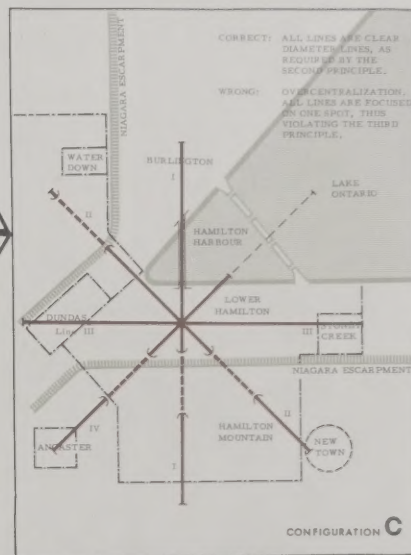
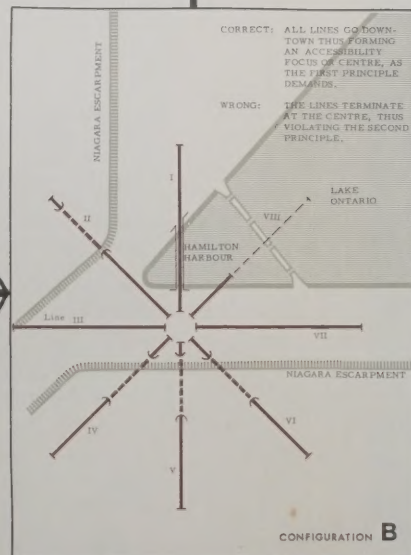
ALL RAPID TRANSIT LINES TO GO DOWNTOWN

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THE PURPOSE OF THIS DOCUMENT IS TO SOLICIT OPINIONS AND TO INVOLVE AS MANY CITIZENS AS POSSIBLE IN THE PLANNING PROCESS.

SECOND PRINCIPLE

ALL LINES TO BE CLEAR DIAMETER LINES, STARTING AND TERMINATING IN OUTER METROPOLITAN AREAS, AND PASSING WITHOUT INTERRUPTION THROUGH THE DOWNTOWN CENTRE.



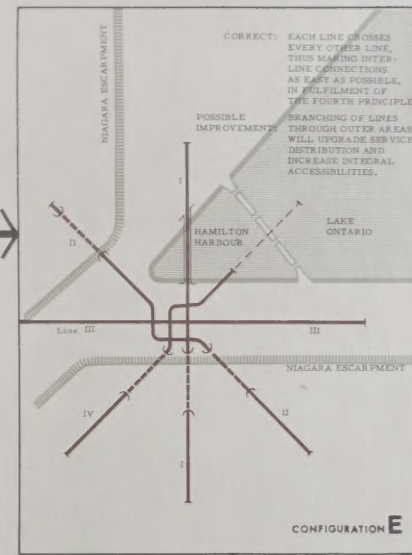
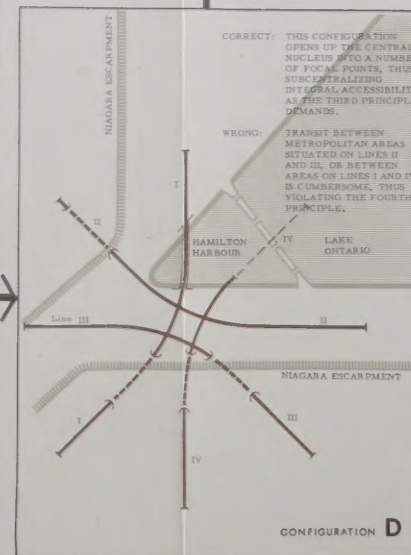
THIRD PRINCIPLE

NO OVERCENTRALIZATION; INTEGRAL ACCESSIBILITY TO BE DISTRIBUTED (WITHIN C.S.D.)

SEE METROPOLITAN TRANSPORT PATTERNS IN THE APPENDIX (FIGURE A, 3)

FOURTH PRINCIPLE

THE PROVISION OF EASY ACCESS BETWEEN ALL LINES, THAT IS, BETWEEN ALL PARTS OF THE URBAN ORGANISM



FIFTH PRINCIPLE

IF NECESSARY, BRANCHING OF LINES FURTHER OUTWARD TO BETTER PERMEATE THE METROPOLITAN AREA (DEPENDS UPON THE NUMBER OF CLEAR DIAMETER LINES AND EXTENT OF THE METROPOLITAN AREA)

RAPID TRANSIT FIVE PRINCIPLES OF GEOMETRIC CONFIGURATION

DRAFT OFFICIAL PLAN 1972 OF THE CITY OF HAMILTON

Subsection 1.3

ALTERNATIVE PATTERNS

GENERAL

Schedule 1-Q and the following text of this subsection present eight alternative proposals of rapid transit patterns as they might be applied in the City of Hamilton planning area. The discussion points out favourable and unfavourable aspects of each pattern, but does not impose any overall judgement. A final decision must take into consideration the opinions of the many public agencies and private enterprises in the city, as well as those of the general public.

(1.3.1)

PATTERN 1

This three line rapid transit system is balanced to serve most of the communities in the Hamilton metropolitan area. The doubling up of alignment in a north-south direction between the Mountain and Burlington will effect savings in land used and construction costs. This doubled alignment intersects an east-west line within the city core, or C.B.D., the essential location of maximum accessibility. The concentrating effect of this single intersection will not be as efficient as that of a pattern which provides two or three nodes of high accessibility (i.e., line interchange stations) all in the central area. A tunnelled ascent of the escarpment at or near James Street and an above-or below-water traverse of Hamilton Harbour will be necessary to ensure minimum travel-times from the heavily populated areas of Burlington and the Mountain to downtown Hamilton. (1.3.2)

On the defect side, the breadth and density of the Lower Hamilton corridor, east of the C.B.D., may require service by more than the one rapid transit line indicated. At present it has one of the highest concentrations of total trips of any corridor focusing on the central area. No direct access is provided to the bayfront industrial area, the major contributor

to peak hour overloads on the existing road system. The low population of the Beach Strip probably does not warrant rapid transit service and may in fact eventually be phased out by industrial and recreational development. Use of the strip as a connector between Burlington and central Hamilton is much too devious an alternative. Lack of service to the Mount Hope Airport may prove to be a disadvantage if commercial air travel to and from the city increases markedly. (1.3.3)

PATTERN 2

This pattern consists of a simple, self-intersecting loop laid down over Lower Hamilton, with tail ends penetrating West Hamilton and the Mountain. Its orientation is basically municipal. Hamilton City Limits are crossed only to gain access to Dundas and Stoney Creek; other peripheral communities, such as Ancaster, Saltfleet New Town, Aldershot, Burlington, and Waterdown, are ignored. This lack of metropolitan concern is the chief drawback of the system, since the majority of rapid transit trips will tend to originate or terminate in the generally less accessible suburbs. (1.3.4)

Locally, the loop provides good distribution of service in the Lower Hamilton corridor. To the north, it passes through the bayfront belt of major industries kinking somewhat to touch upon the Greater Hamilton Shopping Centre; to the south it penetrates continuous residential development; to the west it focuses on the C.B.D. where the two arms of the loop intersect; and to the east it connects Van Wagner's Beach and Confederation Park to central Stoney Creek through an undeveloped area of both industrial and residential potential. (1.3.5)

As opposed to the direct tunnel suggested in Pattern 1, Mountain access may be achieved by a tangential ascent up the side of the Escarpment to the east. At a 3% gradient, however, the length of the climb would be two miles of virtual inaccessibility. Once at the top, the line would be too far east to suit the majority of Mountain dwellers, even if the alignment were to double back on itself along Mohawk Road, as indicated. (1.3.6)

PATTERN 3

Though composed of three lines, this pattern exhibits only one full intersection node, appropriately located in the C.B.D. Basically the pattern consists of two lines descending from the

west and east halves of the Mountain, approximately on Upper James and Upper Ottawa Street alignments, intersecting in the C.B.D., and continuing, respectively, east along Barton Street to terminate in Stoney Creek, and west via Main or King towards a Dundas terminal. These two lines run parallel through the lower city between James and Gage Streets, providing good service to a belt of dense residential development. In addition, the Barton alignment is fairly contiguous to the bayfront industrial concerns, though perhaps not quite near enough for a significant reduction in the use of the automobile for daily work trips to and from the factories. (1.3.7)

The third line originates in Burlington and is routed across the Beach Strip to join into the Barton line in a T-intersection at Strathearne Avenue. This intersection, which may be called a half node or branching node, will concentrate integral accessibility, and inevitably attract commercial development. Competitive development at any such node will invariably weaken and inhibit development in the C.B.D., whereas at this stage in its growth, it is desirable that Hamilton direct all major development towards vitalizing its core. (1.3.8)

From almost any point of view, the Beach Strip is a poor location for rapid transit alignment. Accessibility along its four-mile length is grossly wasted on a very small supporting population. Furthermore, a physical barrier presents itself in the form of the shipping canal which gives entrance to Hamilton Harbour. Minimum clearances for this canal range from 120 feet overhead to 40 feet underground. This fact alone jeopardizes the shaky contention that the Beach Strip is ideal because it forms a land bridge between Burlington and Hamilton. Another drawback of the strip alignment is that it doubles the direct distance between the cores of Burlington and Hamilton. (1.3.9)

The twin Mountain lines may adequately channel residents down to the C.B.D., and much less adequately to other parts of the Lower city, but they in no way permit cross-Mountain movement, save between the East Mountain and Saltfleet New Town. And by simple arithmetic, two Mountain lines equals two costly descents of the Escarpment. (1.3.10)

PATTERN 4

The three lines forming this pattern are: an inverted U, seated on Barton Street, with arms extending southward through the

C.B.D. and Stoney Creek to the top of the Escarpment at Upper James and Saltfleet New Town; an east-west line from Dundas to Stoney Creek, passing through the C.B.D.; and a backwards L which bisects the harbour and lower city between central Burlington and the Mountain, thence bearing west across the Mountain to Ancaster. (1.3.11)

The extent and distribution of service is fairly good, and the parallel east-west alignments through most of the lower city are well-suited to the density of overall development in that area. (1.3.12)

The pattern, however, illustrates a critical defect in the dispersal of full intersection nodes throughout the city. No less than four nodes of equal integral accessibility are created in competition with the C.B.D. For an established metropolis of well over a million inhabitants, decentralization in this manner may be a valid and desirable urban form, in order to cope with the intensified problems of congestion and trip lengths which arise at that scale. Such is the case with Toronto. In Hamilton, there is still plenty of scope for central expansion and development. Efforts should be concentrated toward building up a C.B.D. which will be competitively attractive on a regional basis to all prospective commercial interests. Such is the essential mechanism of growth. (1.3.13)

The Barton Street alignment is again questionable as an effective distributor to the industrial area, particularly in light of possible competition from a proposed freeway on the same alignment. Access is provided to the central bayfront industries, and to Stelco in particular, by the Burlington north-south line. However, the direct extension of this line from Stelco north to Burlington requires a three mile crossing of Hamilton Harbour, which is at once expensive and non productive of ridership. A harbour crossing at some point would probably be preferable to the deviousness and difficulties of a land connection over the Beach Strip, but not in this location. It will be noted furthermore that the Burlington-Ancaster line does not pass through the core of Hamilton, voiding one of the major principles laid down at the beginning of this section. (1.3.14)

PATTERN 5

This pattern explicitly demonstrates the principle of a balanced, expanding radial network emanating from a C.B.D. focus.

The network consists of two lines which branch into a total of eight circumferentially distributed terminals on the metropolitan fringe. These eight branches interconnect with modes of regional transportation, including virtually every major existing or proposed King's Highway leading into Hamilton, as well as trunk railway lines and the Hamilton Municipal Airport at Mount Hope. (1.3.15)

Rather than being essentially straight, both major lines are kinked at the middle in a right-angle bend. These bends overlap in the C.B.D., creating two foci of high accessibility in the downtown area. Whereas multiple interchanges outside the C.B.D. result in soporiphic decentralization, multiple interchanges within the C.B.D. increase the flexibility of overall access and advance the spatial organization and orderly clustering of development in the downtown area without disrupting the integral core identity. We shall call this concentrated deployment of interchange nodes "subcentralization" of the C.B.D., bearing in mind that it has a greatly different meaning from urban "decentralization". (1.3.16)

The kinking arrangement also unites the two most extensively developed areas of the city - the Mountain and Lower Hamilton - on a common line of rapid transit passing through the core. Accordingly, this common line appears to become a primary candidate for the first phase of rapid transit implementation. The second line would subsequently complement the system by tying in the populations of Burlington and Dundas, at its opposite extremes, with the Hamilton core. (1.3.17)

Hamilton Harbour is traversed obliquely at its narrowest point, between the North End and Willow Point. The length of crossing is here less than a mile, which is a standard length of run between suburban rapid transit stations. This crossing chops several miles off the alternative land routes, is the shortest of all harbour traverse proposals, and would lead to the provision of transit service throughout the entire length of North Shore development, from the Botanical Gardens through Aldershot and into Burlington central. (1.3.18)

One disadvantage of such a comprehensive pattern is the number of required escarpment ascents - five, in this proposal. However, the result is worthwhile, since it opens up for urban expansion the entire surrounding plateau at no less than six terminal locations: Saltfleet New Town, two on the Mountain, Ancaster, Greensville (via Dundas), and Waterdown. At least three of these terminals may be developed into regional shopping centres in conjunction

with provincial highway accessibility, as proposed in the recent Hamilton Area Regional Development Study, 1968. (1.3.19)

PATTERN 6

An east-west line and a north-south line form a single, straightforward pattern. The former follows the natural lowland trend, between the Escarpment and the bay and up the Dundas Valley. The latter line, running as it were against the grain of topography, must negotiate the Escarpment, and is also indicated here crossing a portion of the harbour. A rounding of the west harbour would be a practical and perhaps preferable alternative to a traverse, conditional upon the infilling and at least partial high-density development of the waterlots between Carroll's Point and the North End. (1.3.20)

Of singular distinction is the merged alignment of the two lines through the downtown area. Depending upon the length of this merger, a chain of consecutive high-accessibility station nodes is developed, as opposed to the single node which is characteristic of a right-angle intersection of two lines. Consequently there is a greater extent of high integral accessibility in the C.B.D. However, the chain should be limited to two or three station intervals only. Otherwise, C.B.D. development assumes a linear form which is inconvenient and restrictive to internal pedestrian movement. (1.3.21)

Composed as it is of a spare two lines, this pattern cannot serve every portion of the metropolitan area. The Mountain line, for example, once gaining access to the top of the Escarpment, is obliged by the relative population distribution to swerve east through the central Mountain and on towards Saltfleet New Town, at the cost of foresaking areas of the West Mountain and Ancaster. The plateau area in and around Waterdown is of necessity also neglected. (1.3.22)

A bayfront industrial alignment, in the vicinity of Burlington Street, is disregarded in preference to a more southerly alignment through the densely populated residential sections of Lower Hamilton. The latter alignment taps a great ridership resource, and would reduce the pressures of Main and King Streets which presently carry high volumes of traffic into the centre of the city. The virtues of the industry-oriented line are somewhat less ascertained. By nature, it would cater exclusively to work trips, and its usefulness would be time-restricted to the peak hour periods. During the rest of the day, ridership would in all

likelihood be negligible. The line would also hope to be sufficiently patronized to release significant areas of valuable industrial land presently used for parking lots. To achieve this, a great deal of care would be necessary in designing the rest of the system to make rapid transit more attractive than the private automobile for the bulk of the employees concerned - to the probable detriment of other goals of rapid transit service. Furthermore, the employment growth potential of the district appears to be threatened by increasing automation and remote control from accessible headquarters in the C.B.D., the saturation of locally developable land, and the trend towards expansion outside the city as evidenced by Stelco's forthcoming Nanticoke complex. (1.3.23)

A culmination of these factors would strongly indicate that the Burlington Street alignment is a dubious alternative to the more southerly proposal, in the Lower Hamilton corridor. (1.3.24)

The decision may of course be avoided by the addition of a third line to the pattern which would operate between the bayfront industrial district and the West Mountain, and merge with the other two lines through the C.B.D. to further increase core accessibility. (1.3.25)

PATTERN 7

The basic distribution of service of this three-line network is similar to that of Pattern 1. The major difference is that the Waterdown branch is replaced by one in the Lower Hamilton corridor, routed through the industrial area. (1.3.26)

The benefits to Hamilton as a whole of a bayfront line, if used, in reducing overall peak hour congestion and in eliminating the wastage of valuable industrial land presently required for employee parking probably outweigh the loss of service to a minor community such as Waterdown, at least until such time as significant growth takes place in the community. Nevertheless, the bayfront line proposal has constraints of its own, as pointed out in the discussion of Pattern 6. (1.3.27)

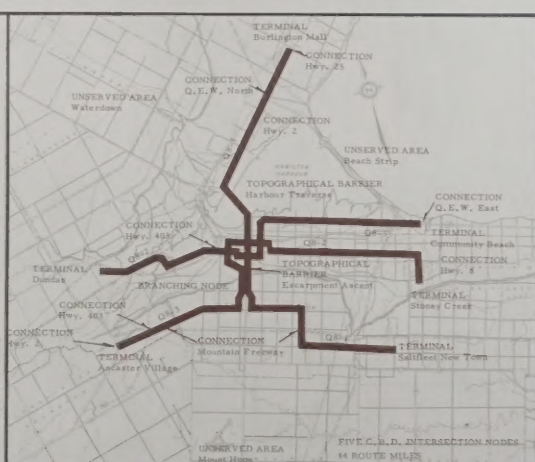
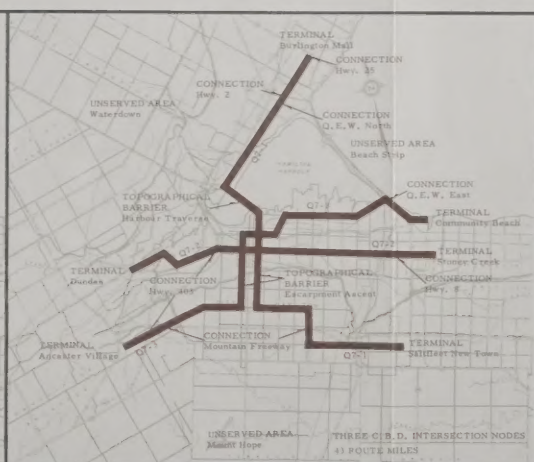
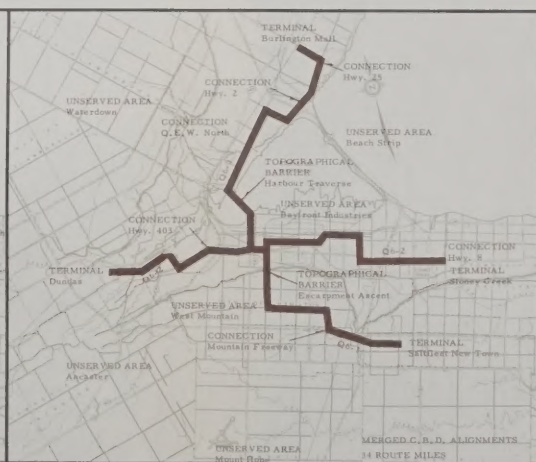
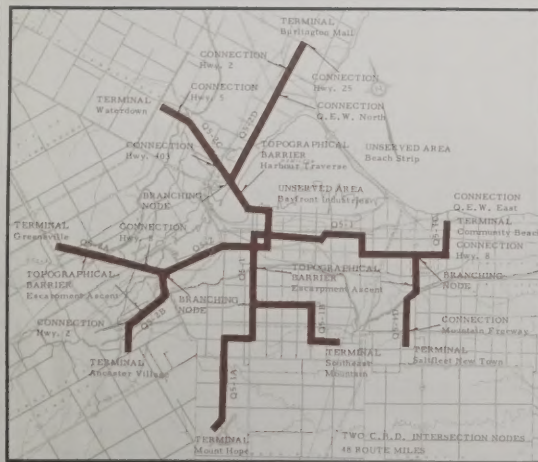
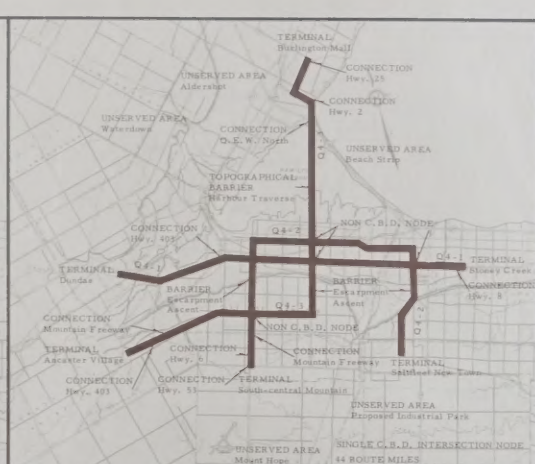
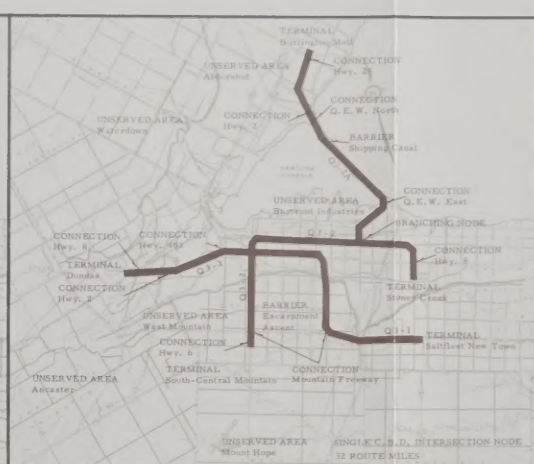
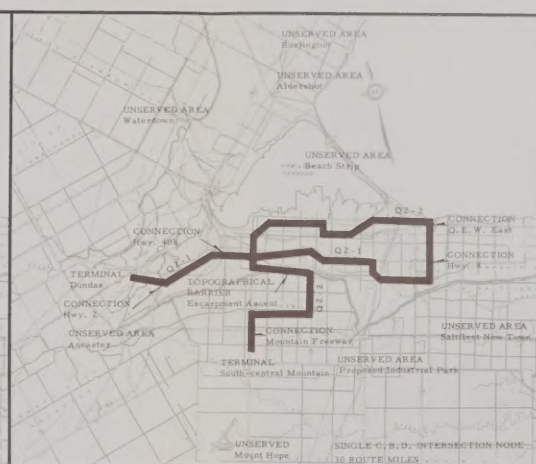
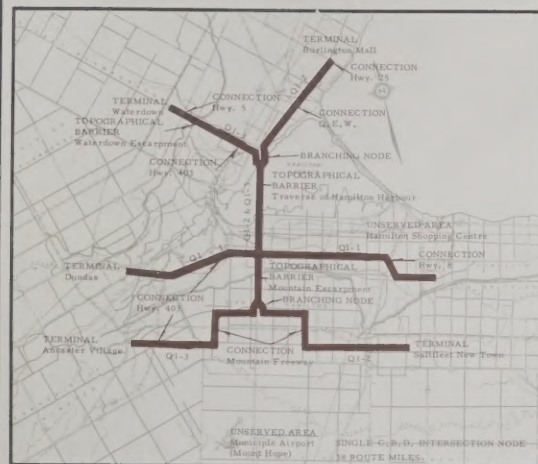
A further distinction from Pattern 1 is the separation of the north-south lines. This separation is the crux of achieving three intersection nodes in the C.B.D., whereby, integral accessibility is increased and distributed over a greater area of the C.B.D. This greater area of accessible land (by rapid transit) in the downtown area will provide an expanded potential

for core development and will reduce the overcrowding that would occur about the single intersection indicated in Pattern 1. (1.3.28)

The airport at Mount Hope remains without rapid transit service. Until such time as a definite expansion program to a viable commercial scale is approved for this airport, and subsequently until such time as a substantially warranting demand exists, an extension of the rapid transit system to the airport is uneconomical and unjustified. In the interim, or in lieu of full scale development of the airport, linkage between the air terminal and downtown Hamilton, or between the terminal and the nearest rapid transit pickup station, may be reasonably accommodated by express bus, taxi, limousine, or private automobile, or combinations thereof. (1.3.29)

PATTERN 8

The rapid transit network shown here is little different, in overall alignment from that proposed as Pattern 7. Minor variations may be noticed in a few branch alignments; these will be discussed in more detail in a later subsection on "Corridors". However, the outstanding feature of this pattern is the manner in which lines merge and cross-connect through the core area. Whereas the advantages of the three-node distribution of accessibility in the C.B.D. have been pointed out in comparison to the single intersection, these same advantages are further pronounced by the five node arrangement as indicated in this alternative. The additional intersections improve the accessibility of selective destinations in the C.B.D. from all corridors of approach, and may be achieved by judicious but simple routing and branch coordination. An inherent component is the merging of two lines at the base of the Escarpment, enabling ascent to the Mountain through a common tunnel. (1.3.30)



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M.T.P.I.C., Dipl. Ing. Arch., Chief Planner, Long Range Section
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Subsection 1.4

CORRIDOR ALIGNMENTS

GENERAL

Schedules 1-R1 to 1-R5 and the following text of this subsection present a more detailed analysis of possible rapid transit alignments in the city and metropolitan area. This area has been broken down to five sectors, or corridors, which possess marked physical identities as a result of natural landforms. Each corridor is studied individually, with respect to prospective alignments. (1.4.1)

BURLINGTON CORRIDOR (Schedule 1-R1)

Hamilton Harbour lies as a natural barrier between Burlington and the Hamilton C.B.D. It may be skirted to the west and east by land routes over the York Street sandbar and the Beach Strip, respectively; or it may be crossed directly. Both land routes are indirect, requiring the construction and/or operation of additional route miles of transit service through areas of little or no supporting population. Furthermore, the York Street sandbar is presently congested with transportation routes, and the Beach Strip requires 120 feet of vertical clearance over the Harbour entrance canal. On the other hand, the direct crossing of Hamilton Harbour at its narrowest point, from Hamilton's North End to Willow Point, minimizes the length of lost accessibility. A third alternative would rest upon the creation of another land route between the North End and Willow Point, by means of filling in the waterlots at the base of the York Street sandbar; this course of action would be particularly attractive if the reclaimed crescent were to be developed in part with medium and high density housing. Between Willow Point and the Q.E.W., Plains Road is the most suitable alignment for

rapid transit by virtue of its linearity, continuity, and its contiguous commercial development. An ideal location of the corridor terminal is in the Burlington Mall shopping centre. A southerly routing of transit between the Q. E. W. and the Mall would pass through the commercial core of Burlington on lower Brant Street; a northerly routing would tie in with the CNR - GO railway station located on Upper Brant Street. (1.4.2)

The provision of a Waterdown branch will probably be a final construction phase in any network scheme, awaiting a considerable population increase in both Waterdown and the intervening low-lands north of Highway 403, and tying in with the construction of a proposed second horseshoe of freeway rounding the western tip of Lake Ontario. (1.4.3)

WEST MOUNTAIN CORRIDOR

(Schedule 1-R2)

Considering the lateral extent of the developed Mountain area in relation to the C.B.D., upper Hamilton would best be served by two lines of rapid transit collecting passengers from east and west, and descending the escarpment in tandem at or near James Street. (1.4.4)

A proposal for the western line is routed down Sanatorium and Mohawk Roads, thence along an abandoned railway easement, terminating in Ancaster Village. On the other hand, a partial alignment along straight Golf Links Road would more evenly bisect the developable area between the Escarpment and Hwy. 53. Both alignments serve the Hamilton District Hospital and intersect the Hwy. 403 extension. If the Escarpment access is tunnelled under West Fifth Street, the Ontario Hospital and Mohawk College may be integrated into the network. (1.4.5)

Should financial or other restrictions dictate but a single line of rapid transit serving the Mountain, a branch formation would enlarge its field of influence within the central and southern Mountain area. One branch may head due south adjacent to Hwy. 6, or via composite of Hwy. 6, Stone Church Road, and an extended Garth Street alignment, as far as Mount Hope and the Hamilton Municipal Airport; the other branch might follow portions of Mohawk, Upper Gage and Stone Church Roads to terminate in a proposed future community node at Upper Ottawa Street. (1.4.6)

EAST MOUNTAIN CORRIDOR

(Schedule 1-R3)

In the event of a two-line Mountain network, as previously suggested, the eastern line ought to extend as far as Saltfleet New Town. Following a proposed escarpment access beneath Upper James or Wellington Streets (the Mountain Plaza shopping centre is located on Upper James), an alignment is again selected adjacent to Mohawk Road, a major arterial locus of future community centres*, which is sufficiently distant from the escarpment bluff to allow a rapid transit tunnel to reach surface level at a limited 3% gradient. (1.4.7)

A slight southerly deviation from the Mohawk alignment in the vicinity of Upper Wentworth Street would provide direct access to the proposed, 60-acre regional shopping centre at Upper Wentworth and Limeridge. Such provision would undoubtedly motivate increased ridership on the line by a fair margin, and would encourage modal interchange from the Mountain Freeway on a park'n'ride basis. (1.4.8)

A natural kink in the escarpment (Red Hill Creek Gorge), and a proposed artificial lake at its head, combine to form a physical barrier between Saltfleet and the rest of the developable Mountain. One solution is to align rapid transit adjacent to proposed Mountain Freeway east of Upper Gage Street, thus cutting across the narrow isthmus between gorge and lake. This measure unfortunately restricts pedestrian access to transit stations by 50%. Alternatively, an alignment may be chosen which will round the artificial lake to the south, passing through the future community centre* located at the intersection of Stone Church Road and Upper Ottawa Avenue. Although this route is somewhat longer, it provides thorough transit access to the proposed industrial area adjacent to the lake. (1.4.9)

* According to Official Plan Amendment 228 (1967) of the Official Plan of Hamilton. In the conceivable event that further examination reveals that the community centres ought to be relocated upon other arterial bands (e.g. Fennell, Limeridge, and Rymal Roads), the alignment of rapid transit logically should follow suit. One such conditional route, parallelling portions of Fennell, Upper Wentworth and Limeridge Roads, is illustrated in Schedule 1-R3.

LOWER HAMILTON CORRIDOR

(Schedule 1-R4)

Leading east from the C.B.D., a number of alternatives are shown indicating the wide variety of eligible rapid transit routes. There are of course the major arterials - Burlington, Barton, Cannon, King and Main Streets. Long collector streets such as Dunsmure, Britannia or Roxborough may also be used to advantage in whole or in part. Furthermore, there is the possibility of alignment through midblock sections adjacent to any of the aforementioned thoroughfares, albeit at the extra cost of purchasing and clearing residential land. (1.4.10)

The density, diversification, and distribution of development in Lower Hamilton suggest the establishment of two lines of rapid transit through this corridor: one to the north serving the industrial sector and the shopping centre via Burlington Street and Beach Road, eventually terminating at Community Beach; the other running through the southern residential masses out to Stoney Creek, possibly on a King-Roxborough or Main-Queenston alignment. Lacking an East Mountain line, a branch or extension of the Stoney Creek line could be run up the escarpment to Saltfleet New Town, if required. (1.4.11)

In the event of but a single line, consideration may be given to a jogging alignment following portions of Cannon Street (high density nodes, Civic Stadium), Barton Street (Hamilton Shopping Centre), and Queenston Road (Hwy. 8) into Stoney Creek. (1.4.12)

DUNDAS CORRIDOR

(Schedule 1-R5)

Main Street West is the only continuous artery leading directly from the C.B.D. of Hamilton through Westdale into Dundas, and as such deserves attention as a rapid transit routing alternative, with perhaps minor variations. A possible variation of a more substantial nature would be to exit the C.B.D. via Bay and Aberdeen Streets, thus serving the apartment-studded residential bloc southwest of downtown and providing access to both the Chedoke Civic Golf Course and an adjacent industrial grouping, before joining into Main Street. (1.4.13)

Neither of these proposals touches upon Westdale Oval (the commercial core of Westdale) nor serves McMaster University as well as a King Street West alignment which, after cutting

through the central university campus, might directly follow around Cootes Drive (perhaps making use of an existing rail right-of-way) into central Dundas. (1.4.14)

In Dundas itself, a "main drag" alignment on King Street might be considered ideal. However, the adjacent, parallel Hatt Street is wider, with a south side largely devoted to industrial uses and an existing spur track running down its centreline. It is consequently a more practical and economical candidate for rapid transit alignment and the location of a line terminal. (1.4.15)

Branch access to Ancaster Village from the Dundas corridor, while remaining a distinct possibility, would require the traversage of an extent of thinly populated uneven terrain, not to mention another ascent of the escarpment. A far superior integration of the Ancaster area into the rapid transit network would be effected through the proposed West Mountain corridor. (1.4.16)

WATERDOWN TERMINAL MAY
EVENTUALLY BE DEVELOPED
INTO A REGIONAL SHOPPING
CENTRE, IN CONJUNCTION WITH
PROPOSED NEW FREEWAY NORTH
OF HWY. 5

POSSIBLE SURFACE ALIGNMENT
ADJACENT TO C.N.R. TRUNK LINE.
STRAIGHT THROUGH ALIGNMENT
ON PROSPECT STREET LEADS
DIRECTLY TO BURLINGTON MALL.

INTEGRATION WITH
GO-TRANSIT STATION.

WATERDOWN ESCARPMENT
POSSES A PHYSICAL BARRIER
WHICH MUST BE OVERCOME.

DIRECT WATERDOWN ACCESS LINE
MAY BE DEVELOPED AS A LATTER
STAGE OF NETWORK IMPLEMEN-
TATION.

WINDING ALTERNATIVE FOLLOWS
HYDRO AND C.P.R. ALIGNMENTS
TO WATERDOWN.

SANDBAR PRESENTLY CHOKED
WITH TRANSPORTATION ROUTES.
A FURTHER ALIGNMENT MAY BE
DIFFICULT TO LOCATE AND INTE-
GRATE.

AERIAL RIGHT-OF-WAY OVER
C.N.R. MAIN LINE MAY BE POS-
SIBLE, BUT THIS ALTERNATIVE
IS INDIRECT AND WITHOUT ACCES-
SIBILITY POTENTIAL.

ON THE OTHER HAND, IF THE
WATERFRONT LOTS ARE FILLED
IN AND DEVELOPED WITH HIGH
DENSITY MULTIPLE DWELLINGS,
AN ALIGNMENT SLIGHTLY TO THE
NORTH OF THAT SHOWN MIGHT
PROVE EXCEEDINGLY PRACTICAL.

HARBOUR CROSSING AT NARROW-
EST POINT, VIA 40 FT. HIGH
BRIDGE OR PREFAB SUNKEN BOX
TUNNEL.

UNNECESSARILY LONG HARBOUR
TRAVERSE.

PLAINS ROAD IS AN EXCELLENT
ALIGNMENT. IT IS STRAIGHT,
WIDE, CONTINUOUS, AND THE
ONLY LOCUS OF COMMERCIAL
DEVELOPMENT THROUGH THIS
SECTION OF THE CORRIDOR.

NORTH SHORE BOULEVARD IS
TOO TWISTING. TERRAIN IS
UNEVEN. AN ALIGNMENT
SWATH WOULD HAVE TO BE
CUT THROUGH HIGH VALUE
REAL ESTATE PROPERTIES
ADJACENT TO HARBOUR.

SOUTHERLY ALIGNMENT PROPOSAL
PASSES THROUGH COMMERCIAL
CORE ON LOWER BRANT STREET.
LEADS TO MALL VIA MAJOR RESI-
DENTIAL ARTERIES; NEW STREET
AND GUELPH LINE.

BRANT STREET ALIGNMENT PRE-
SENTS PROTRACTED DIFFICULTIES
IN LOCATION THROUGH DENSELY
DEVELOPED AREA, BUT WOULD
PROVIDE EXTENDED COMMERCIAL
ACCESSIBILITY.

LAKESHORE ALIGNMENT USES UP
VALUABLE LAND, BETTER SUITED
TO RECREATIONAL AND/OR LUXURY
RESIDENTIAL DEVELOPMENT.

TERMINAL LOCATION IDEALLY
WITHIN OR ADJACENT TO BURLING-
TON MALL SHOPPING CENTRE.
A PORT NELSON TERMINAL WOULD
NOT HAVE THE SAME ATTRACTION
AS ONE LOCATED IN BURLINGTON
MALL.

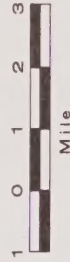
SCHEDULE

1.R1

BURLINGTON CORRIDOR

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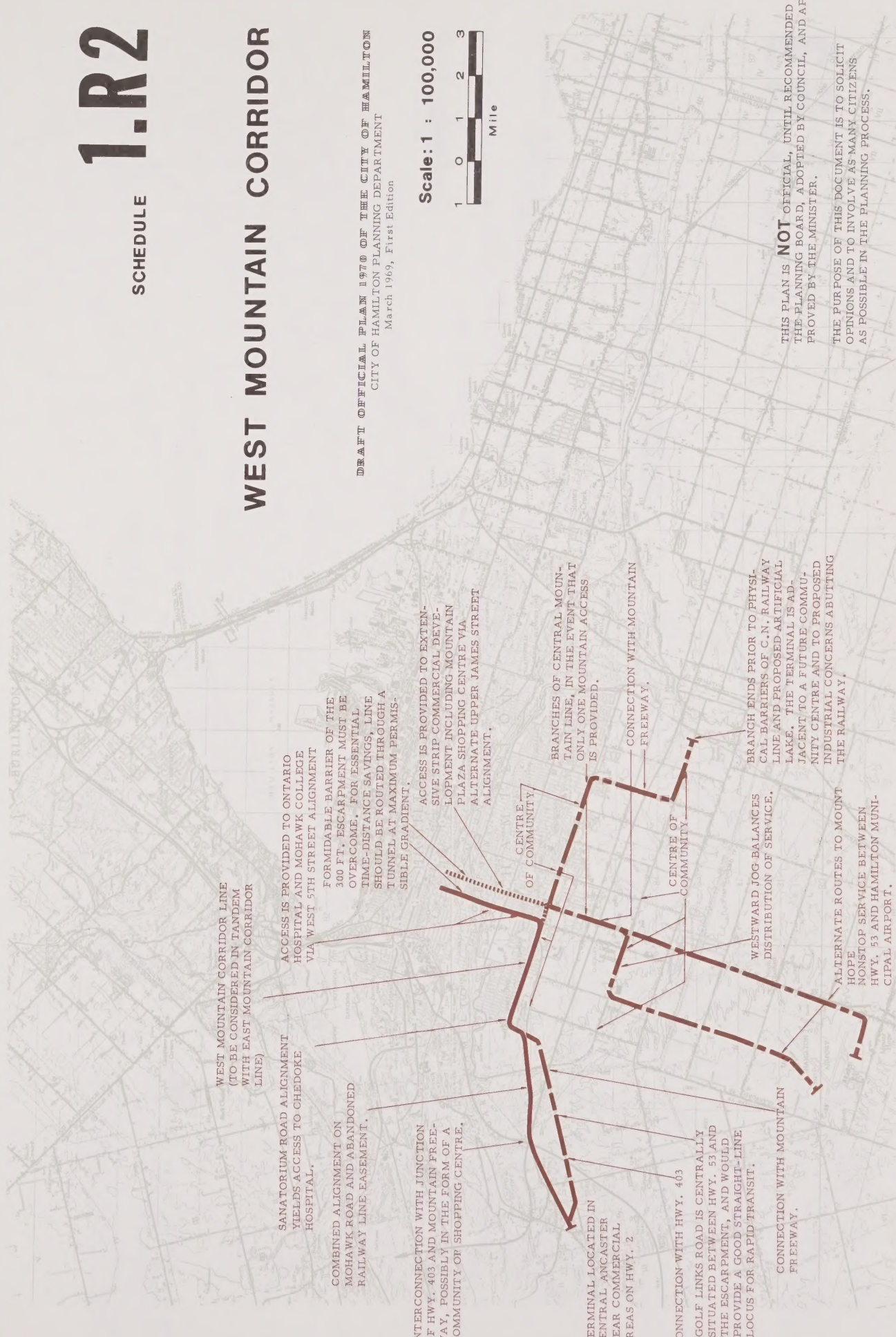
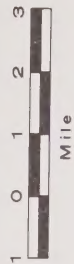
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SCHEDULE 1.R2

WEST MOUNTAIN CORRIDOR

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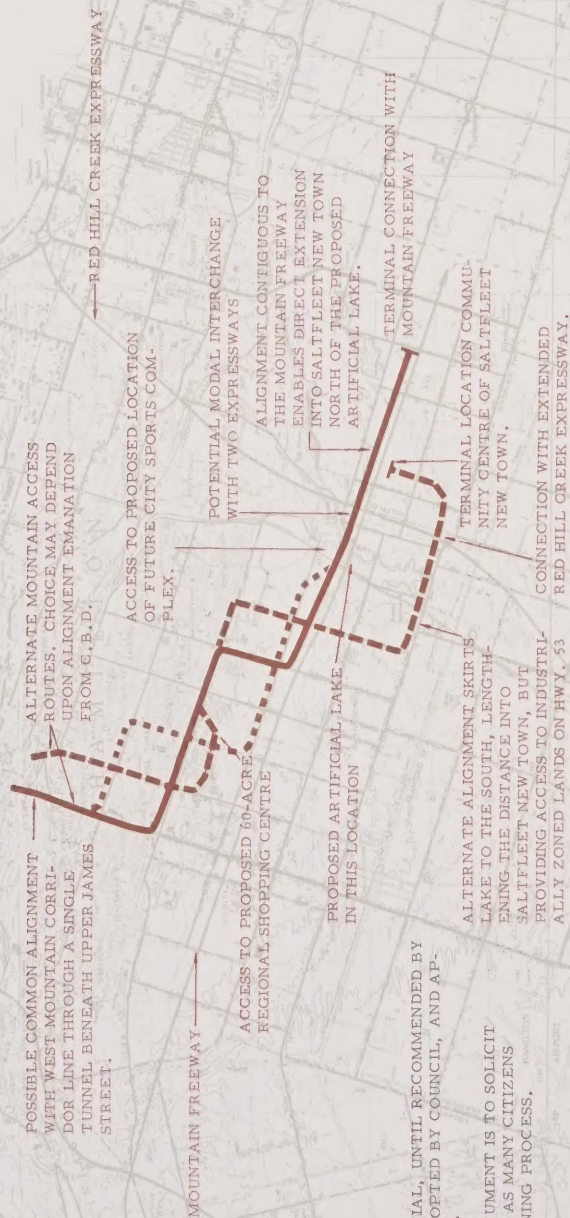
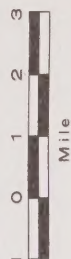
1.R3

SCHEDULE

EAST MOUNTAIN CORRIDOR

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1.R4

SCHEDULE

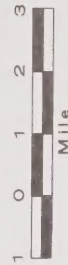
LOWER HAMILTON CORRIDOR

ACCESS TO THE HARBOUR INDUSTRIAL AREA. THIS INDUSTRIAL LINE MAY BE OPERATED IN TANDEM WITH A KING-ROXBOROUGH, OR MAIN-QUEENSTON LINE SERVING THE RESIDENTIAL AREAS FURTHER TO THE SOUTH.

RESTRICTIVE SINGLE-LINE SERVICE THROUGH THE LOWER CITY MAY DISTRIBUTE ACCESSIBILITY BY MEANS OF A COMPOSITE ALIGNMENT ON SEVERAL ARTERIALS, SUCH AS PORTIONS OF CANNON, BARTON, STRATH-EGARNE, AND KING STREETS AS ILLUSTRATED.

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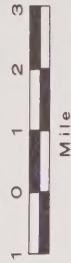
1.R5

SCHEDULE

DUNDAS CORRIDOR

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NONSTOP SERVICE FROM MCMASTER TO DUNDAS MAY SKIRT THE DEVELOPED AREA, PERMITTING AT-GRADE CONSTRUCTION OF TRACK BASE OR, ALTERNATIVELY, MAKING USE OF THE EXISTING T.H. & B. SPUR LINE, ADJACENT TO COOTES DRIVE.

MCMASTER UNIVERSITY

WESTDALE CENTRE

KING STREET ALIGNMENT PASSES THROUGH COMMERCIAL CENTRE OF WESTDALE AND BISECTS MC-MASTER CAMPUS.

CONNECTION WITH HWY. 403

WESTINGHOUSE

ENTRANCE INTO CENTRAL HAMILTON MAY BE ROUTED ALONG ABERDEEN AND BAY STREETS, INSTEAD OF CONTINUING DIRECTLY IN ON MAIN STREET. THE ABERDEEN ROUTE WOULD LEND ACCESSIBILITY TO THE WESTINGHOUSE WORKS AND CHEDOKE CIVIC GOLF COURSE, AS WELL AS TO THE DENSE RESIDENTIAL AREA SOUTHWEST OF THE C.B.D.

CHEDOKE CIVIC GOLF COURSE.

MAIN STREET IS A WIDE DIRECT CORRIDOR ALTERNATIVE THROUGH WEST HAMILTON, ABUTTED BY CONSIDERABLE COMMERCIAL AND APARTMENT DEVELOPMENT.

BAY STREET IS FLANKED BY HIGH-RISE APARTMENT DWELLINGS, AND ENTERS THE C.B.D. ADJACENT TO CITY HALL.

TWO ALTERNATIVES OF A POSSIBLE BRANCH LINE FROM THE DUNDAS CORRIDOR UP THE ESCARPMENT TO ANCASTER. THE INTERVENING TERRAIN IS IRREGULAR AND SPARSELY DEVELOPED, AND THE ESCARPMENT OF COURSE POSES A FURTHER ENGINEERING PROBLEM. SERVICE TO ANCASTER WOULD APPEAR TO BE PREFERABLE VIA THE WEST MOUNTAIN CORRIDOR.

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Subsection 1.5

CENTRAL BUSINESS DISTRICT TRANSIT SCHEMES

GENERAL

Accessibility and its distribution are the principal factors of core development, governing both the rate and form of growth. Schedules 1-S1 to 1-S6 and the following text of this subsection address the merits of alternative rapid transit configurations in the C.B.D. (1.5.1)

C.B.D. TRANSIT SCHEME 1 (Schedule 1-S1)

The four transit corridors converge here in a single focus within the C.B.D. The location of the point of intersection must relate to route continuity and ease of alignment (physical factors), the intensity of commercial development (land use), and accessibility to the terminals of other transportation modes (balanced transportation). It is rare that these three conditions may be met simultaneously in a single existing location. (1.5.2)

The recognized existing core of Hamilton is at the intersection of King Street and James Street, both of which are continuous, heavily commercialized traffic arteries. It is a logical spot on which to focus rapid transit, therefore, satisfying two of the three criteria. The decentralization of terminals, particularly the C.N.R. terminal on James Street North, creates an impasse in satisfying the third criterion without sacrificing the other two. Such terminals may be served by one branch or another, and thus be accessible from all parts of the system only via transfer stations. (1.5.3)

Actually, the question is not whether a poorly located regional terminal warrants rapid transit access, but rather whether a

growing city such as Hamilton is prepared in the first place to accept the functional inefficiency and inhibition to effective regional communication which are automatically imposed by an ill-located terminal. A regional terminal must be backed up by immediately accessible business and commercial facilities if the city hopes to attract enterprises with wide range interests. Yet each such enterprise will want good local communications (such as rapid transit) to meet their requirements of accessible staff, service, and patronage. Consequently, Hamilton would be remiss in its planning not to consider the grouping and relocation of its regional scale termini as a multi-mode transportation centre within the C.B.D., in concert with the local distribution network. (1.5.4)

Main Street is chief contender to a King Street line, but the nature of its commercial development is more civic and financial than retail and social. (1.5.5)

C.B.D. TRANSIT SCHEME 2

(Schedule 1-S2)

Again with a single point focus of peak integral accessibility, this C.B.D. pattern relates to the simplified, closed-loop network No. 2. There is more bending in this layout to make use of existing rail easements. Hughson Street is followed, being a direct north-south link between the C.N.R. and T.H.&B. terminal stations, a mere block east of commercialized James Street. The east-west alignment is maintained on King Street, with one major exception. The line curves south on Bay Street, passing City Hall and penetrating a high density apartment area, before continuing along Aberdeen to West Hamilton. The intersection point of rapid transit lines is 350 feet further east than in the previous C.B.D. pattern; the difference in effect is negligible. In the short range, the C.N. station is served in its present location. Long range development forecasts should include a new transportation centre near the rapid transit intersection, perhaps adjacent to the T.H. & B. terminal in the downtown area. (1.5.6)

C.B.D. TRANSIT SCHEME 3

(Schedule 1-S3)

With three convergent lines, three intersections are readily attainable. As explained in Subsections 1.2 and 1.3 of this Article, subcentralization of accessibility into two or three nodes within the C.B.D. has its advantages (grouping similar commercial

functions; creating a balanced space arrangement). The three intersections depicted are at Main and Bay, Main and James, and the C.N.R. station. In practise this would not be a viable distribution. (1.5.7)

One wishes that a less alienated location would have been selected in the past for the C.N.R. station, as already pointed out. In its present location outside the C.B.D., it does not warrant node status. A northward expansion of the C.B.D. to encompass the C.N.R. station would be contrary to the geography of the city and would create a barrier against east-west traffic flows below the escarpment. (1.5.8)

The other two nodes, as may be seen, focus on City Hall, the Board of Education Building, the County Court House, and the Post Office, overemphasizing the civic functions of the C.B.D. and underplaying its vital retail and commercial concentrations. (1.5.9)

C.B.D. TRANSIT SCHEME 4

(Schedule 1-S4)

An improved version of the three node pattern accommodates eastward expansion of the C.B.D. The Main Street line is shifted up to King Street, the north-south line is moved over from James to Ferguson Avenue, and the Bay Street line bends east along Cannon Street as far as Victoria Avenue before continuing north, past the General Hospital, toward the harbour industrial area. (1.5.10)

This plan follows more closely the existing and probable future trends of C.B.D. development. The vacant C.N.R. yard at the Cannon-Ferguson intersection node may be a suitable location for a transporation centre. The transit stops on Cannon and east King Streets will become potential sites for high-rise commercial growth. (1.5.11)

C.B.D. TRANSIT SCHEME 5

(Schedule 1-S5)

The standard relationship between two convergent lines is a single point intersection. However, by right-angling each line through the C.B.D., two cross-over points may result, as illustrated. (1.5.12)

The intersection at Main and James is equally accessible from City Hall, Civic Square, a possible King Street shopping mall, and the T.H. & B. station. The other node is situated at Cannon and Ferguson on a spur from the C.N. main track line. The Ferguson freight yard is a good location for a future multi-mode terminal, and the intersection of Ferguson and Cannon Streets is well suited for commercial and business development. However the fact that the two intersections are offset from each other upon the existing street grid would create difficulties in joining them by a direct pedestrian mall. (1.5.13)

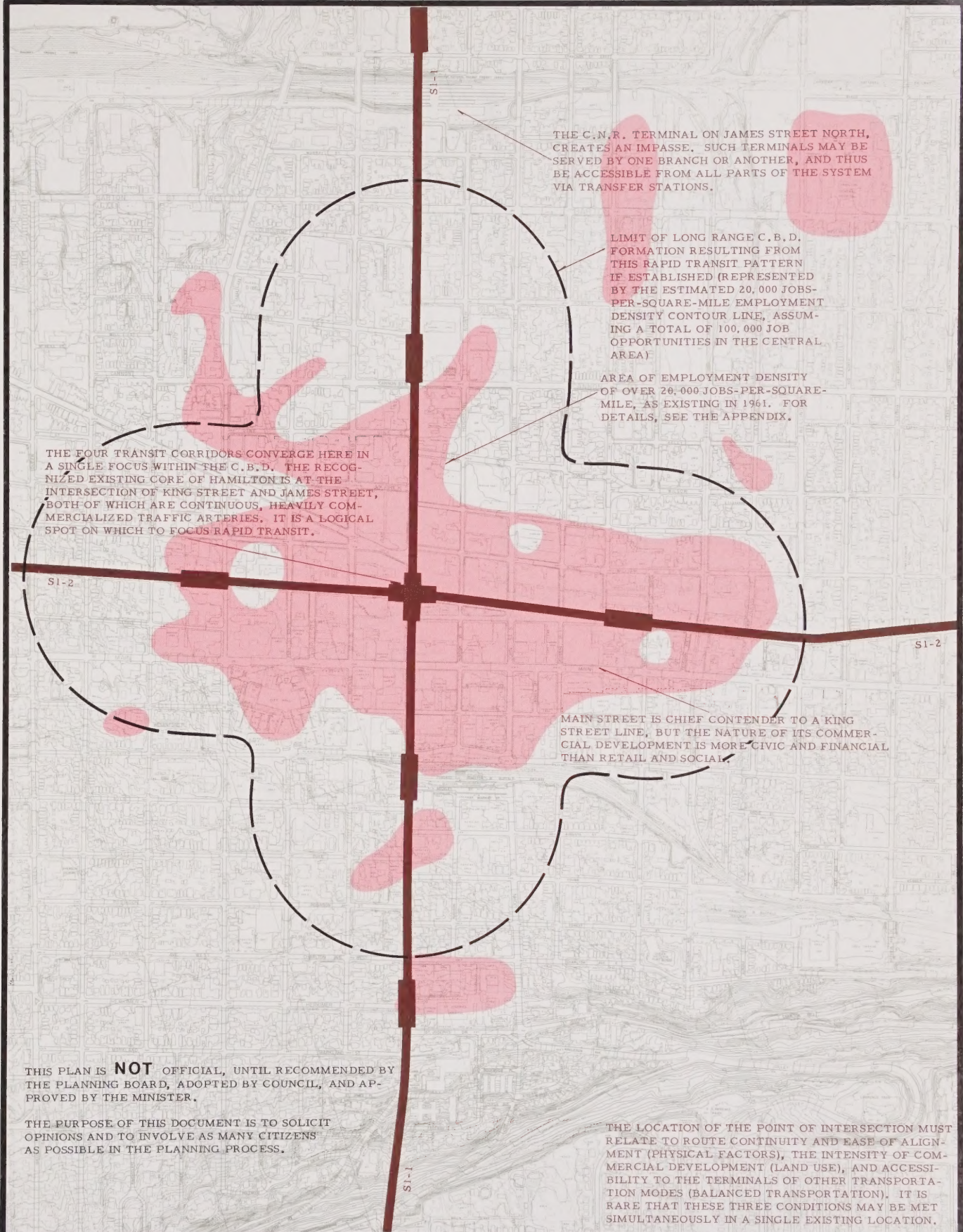
The nature of such a transit layout is that the radial corridors of any one line are in adjacent rather than opposite quadrants. This would normally be of hindrance to a city with a centrally oriented core. In Hamilton, however, the C.B.D. is in the northwest corner, with most of the city lying to the east and south. Thus, the bulk of the population is still routed through the C.B.D. by a single line. The other line brings central Hamilton into contact with the large suburban communities of Burlington and Dundas. (1.5.14)

C.B.D. TRANSIT SCHEME 6

(Schedule 1-S6)

Colinear routing of a two line rapid transit system along the main commercial thoroughfare within the C.B.D. is a common as well as effective design procedure, creating a strong linear core nucleus of unmatched accessibility. King Street is the most obvious contender for this functional distinction. The C.B.D., however, should not be excessively elongated. The extent of the combined alignment is thus best restricted to two or three station-stops. (1.5.15)

The system shown runs double between James and Ferguson Streets. There is just room enough for two stations on this high-accessibility portion through the centre of the C.B.D. A central commuter rail terminal may be located on Ferguson at King Street, integrated with the junction point of rapid transit line branches serving the Mountain and East Hamilton. (1.5.16)



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Scale: 1" = 1000'

C.B.D. TRANSIT SCHEME 1

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SCHEDULE

1.S1

IN THE SHORT RANGE, THE C.N. STATION IS SERVED IN ITS PRESENT LOCATION.

HUGHSON STREET IS FOLLOWED, BEING A DIRECT NORTH-SOUTH LINK BETWEEN THE C.N.R. AND T.H.&B. TERMINAL STATIONS, A MERE BLOCK EAST OF COMMERCIALIZED JAMES STREET.

LIMIT OF LONG RANGE C.B.D. FORMATION RESULTING FROM THIS RAPID TRANSIT PATTERN IF ESTABLISHED (REPRESENTED BY THE ESTIMATED 20,000 JOBS-PER-SQUARE-MILE EMPLOYMENT DENSITY CONTOUR LINE, ASSUMING A TOTAL OF 100,000 JOB OPPORTUNITIES IN THE CENTRAL AREA).

AREA OF EMPLOYMENT DENSITY OF OVER 20,000 JOBS-PER-SQUARE-MILE, AS EXISTING IN 1961. FOR DETAILS, SEE THE APPENDIX.

THE EAST-WEST ALIGNMENT IS MAINTAINED ON KING STREET, WITH ONE MAJOR EXCEPTION, THE LINE CURVES SOUTH ON BAY STREET, PASSING CITY HALL AND PENETRATING A HIGH DENSITY APARTMENT AREA, BEFORE CONTINUING ALONG ABERDEEN TO WEST HAMILTON.

THE INTERSECTION POINT OF RAPID TRANSIT LINES IS 350 FEET FURTHER EAST THAN IN THE PREVIOUS C.B.D. PATTERN.

THERE IS MORE BENDING IN THIS LAYOUT TO MAKE USE OF EXISTING RAIL EASEMENTS.

LONG RANGE DEVELOPMENT FORECASTS SHOULD INCLUDE A NEW TRANSPORTATION CENTRE NEAR THE RAPID TRANSIT INTERSECTION, PERHAPS ADJACENT TO THE T.H. & B. TERMINAL IN THE DOWNTOWN AREA.

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WITH A SINGLE POINT FOCUS OF PEAK INTEGRAL ACCESSIBILITY, THIS C.B.D. PATTERN RELATES TO THE SIMPLIFIED, CLOSED-LOOP NETWORK NO. 2

R. BAILEY M.T.P.I.C., P. Eng., Commissioner of Planning and Secretary-Treasurer of the Planning Board
O.C.A. LANGMARK M.T.P.I.C., Dipl. Ing. Arch., Chief Planner, Long Range Section
B.J. KLOTZ B.Sc., Officer in charge

Scale: 1" = 1000'

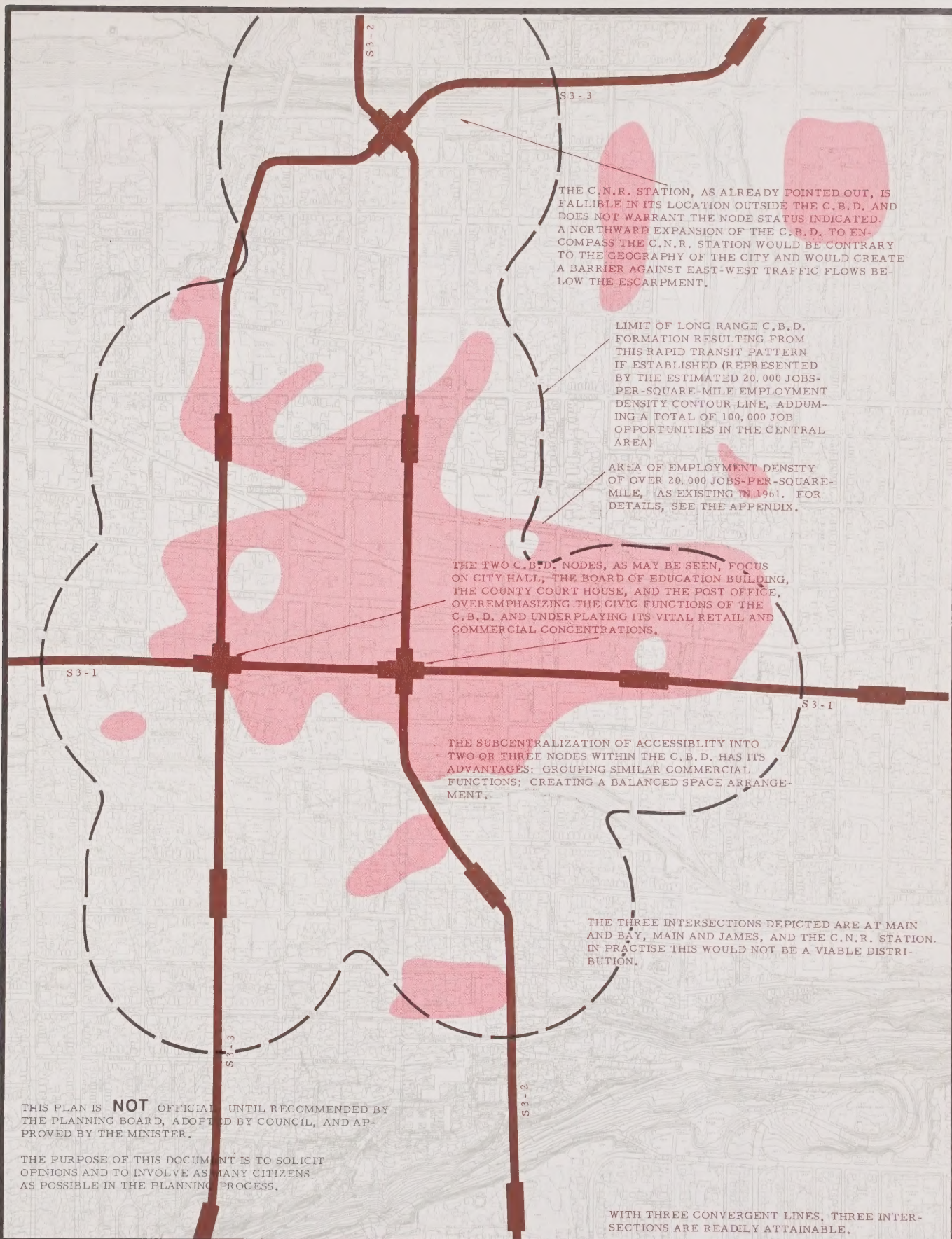
C.B.D. TRANSIT SCHEME 2



DRAFT OFFICIAL PLAN 1970 OF THE CITY OF HAMILTON
CITY OF HAMILTON PLANNING DEPARTMENT
March 1969, First Edition

SCHEDULE

1.S2



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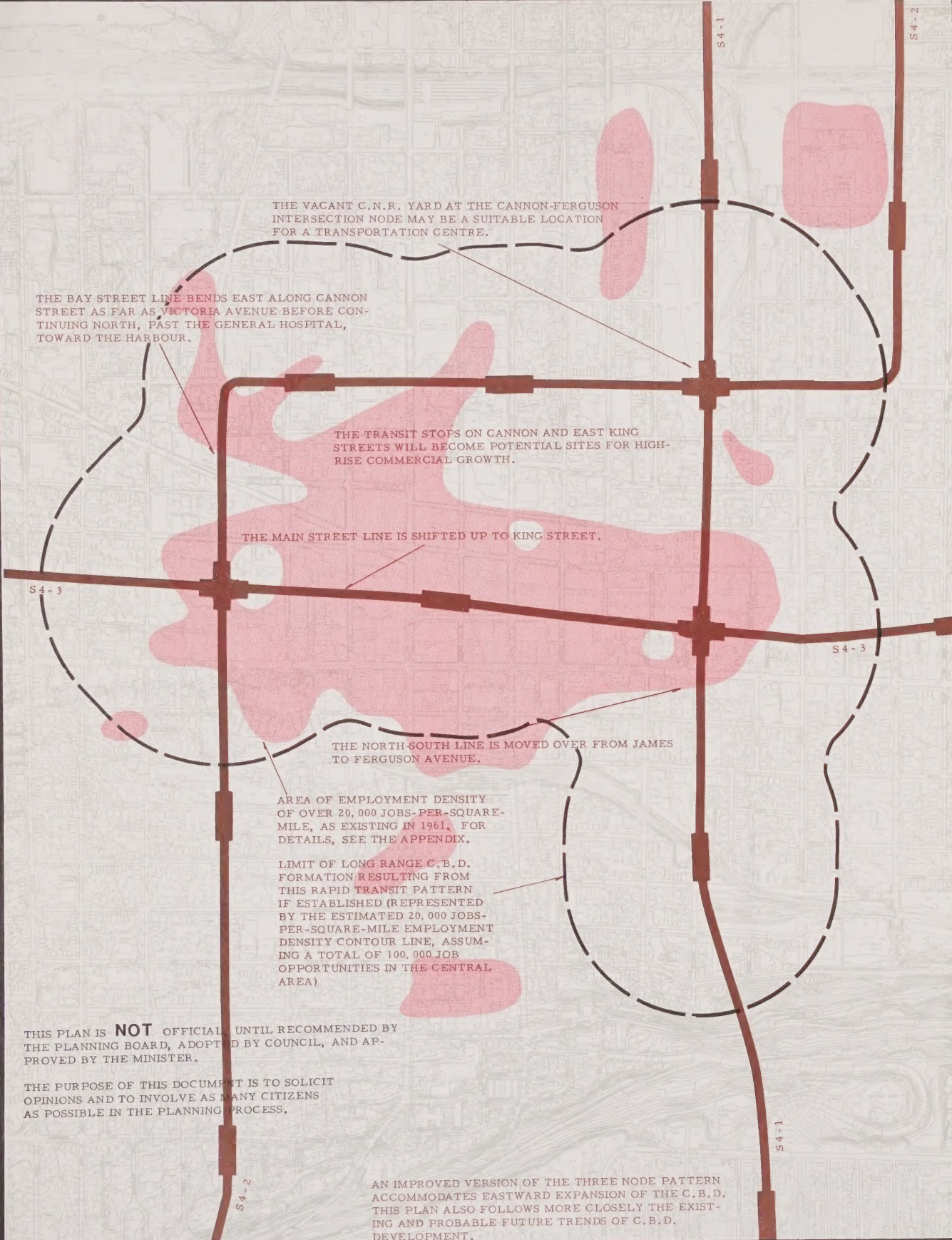
Scale: 1" = 1000'

C.B.D. TRANSIT SCHEME 3

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 CITY OF HAMILTON PLANNING DEPARTMENT
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SCHEDULE

1.S3



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C.B.D. TRANSIT SCHEME 4

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SCHEDULE

1.S4

ACTUALLY, THE QUESTION IS NOT WHETHER A POORLY LOCATED REGIONAL TERMINAL WARRANTS RAPID TRANSIT ACCESS, BUT RATHER WHETHER A GROWING CITY SUCH AS HAMILTON IS PREPARED IN THE FIRST PLACE TO ACCEPT THE FUNCTIONAL INEFFICIENCY AND INHIBITION TO EFFECTIVE REGIONAL COMMUNICATION WHICH ARE AUTOMATICALLY IMPOSED BY AN ILL-LOCATED TERMINAL.

IN HAMILTON, THE C.B.D. IS IN THE NORTH-WEST CORNER, WITH MOST OF THE CITY LYING TO THE EAST AND SOUTH. THUS, THE BULK OF THE POPULATION IS STILL ROUTED THROUGH THE C.B.D. BY A SINGLE LINE.

THE OTHER NODE IS SITUATED AT CANNON AND FERGUSON ON A SPUR FROM THE C.N. MAIN TRACK LINE. THE FERGUSON YARD IS A GOOD LOCATION FOR A FUTURE MULTI-MODE TERMINAL, THE INTERSECTION OF FERGUSON AND CANNON STREET IS WELL SUITED FOR COMMERCIAL AND BUSINESS DEVELOPMENT.

THE INTERSECTION AT MAIN AND JAMES IS EQUALLY ACCESSIBLE FROM CITY HALL, CIVIC SQUARE, A POSSIBLE KING STREET SHOPPING MALL, AND THE T.H.&B. STATION.

THE OTHER LINE BRINGS CENTRAL HAMILTON INTO CONTACT WITH THE LARGE SUBURBAN COMMUNITIES OF BURLINGTON AND DUNDAS.

AREA OF EMPLOYMENT DENSITY OF OVER 20,000 JOBS-PER-SQUARE-MILE, AS EXISTING IN 1961. FOR DETAILS, SEE THE APPENDIX.

LIMIT OF LONG RANGE C.B.D. FORMATION RESULTING FROM THIS RAPID TRANSIT PATTERN IF ESTABLISHED (REPRESENTED BY THE ESTIMATED 20,000 JOBS-PER-SQUARE-MILE EMPLOYMENT DENSITY CONTOUR LINE, ASSUMING A TOTAL OF 100,000 JOB OPPORTUNITIES IN THE CENTRAL AREA)

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THE STANDARD RELATIONSHIP BETWEEN TWO CONVERGENT LINES IS A SINGLE POINT INTERSECTION. HOWEVER, BY RIGHT-ANGLING EACH LINE THROUGH THE C.B.D., TWO CROSS-OVER POINTS MAY RESULT, AS ILLUSTRATED. THE NATURE OF SUCH A TRANSIT LAYOUT IS THAT THE RADIAL CORRIDORS OF ANY ONE LINE ARE IN ADJACENT RATHER THAN OPPOSITE QUADRANTS. THIS WOULD NORMALLY BE OF HINDRANCE TO A CITY WITH A CENTRALLY ORIENTED CORE.

R. BAILEY M.T.P.I.C., P. Eng., Commissioner of Planning and Secretary-Treasurer of the Planning Board
O.C.A. LANGMARK M.T.P.I.C., Dipl. Ing. Arch., Chief Planner, Long Range Section
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C.B.D. TRANSIT SCHEME 5

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SCHEDULE

1.S5

LIMIT OF LONG RANGE C.B.D. FORMATION RESULTING FROM THIS RAPID TRANSIT PATTERN IF ESTABLISHED (REPRESENTED BY THE ESTIMATED 20,000 JOBS-PER-SQUARE-MILE EMPLOYMENT DENSITY CONTOUR LINE, ASSUMING A TOTAL OF 100,000 JOB OPPORTUNITIES IN THE CENTRAL AREA)

AREA OF EMPLOYMENT DENSITY OF OVER 20,000 JOBS-PER-SQUARE-MILE, AS EXISTING IN 1961. FOR DETAILS, SEE THE APPENDIX.

THE C.B.D., SHOULD NOT BE EXCESSIVELY ELONGATED. THE EXTENT OF THE COMBINED ALIGNMENT IS THUS BEST RESTRICTED TO TWO OR THREE STATION STOPS. THE SYSTEM SHOWN RUNS DOUBLE BETWEEN JAMES AND FERGUSON STREETS. THERE IS JUST ROOM ENOUGH FOR TWO STATIONS ON THIS HIGH-ACCESSIBILITY PORTION THROUGH THE CENTRE OF THE C.B.D. KING STREET IS THE MOST OBVIOUS CONTENDER FOR THIS FUNCTIONAL DISTINCTION.

A REGIONAL TERMINAL MUST BE BACKED UP BY IMMEDIATELY ACCESSIBLE BUSINESS AND COMMERCIAL FACILITIES IF THE CITY HOPES TO ATTRACT ENTERPRISES WITH WIDE RANGE INTERESTS. YET EACH SUCH ENTERPRISE WILL WANT GOOD LOCAL COMMUNICATIONS (SUCH AS RAPID TRANSIT) TO MEET THEIR REQUIREMENTS OF ACCESSIBLE STAFF, SERVICE, AND PATRONAGE. A CENTRAL COMMUTER RAIL TERMINAL MAY BE LOCATED ON FERGUSON AT KING STREET, INTEGRATED WITH THE JUNCTION POINT OF RAPID TRANSIT LINE BRANCHES SERVING THE MOUNTAIN AND EAST HAMILTON, AND FORMING A MULTI-MODE TRANSPORTATION CENTRE WITHIN THE C.B.D., IN CONCERT WITH THE LOCAL DISTRIBUTION NETWORK.

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COLINEAR ROUTING OF A TWO LINE RAPID TRANSIT SYSTEM ALONG THE MAIN COMMERCIAL THOROUGHFARE WITHIN THE C.B.D. IS A COMMON AS WELL AS EFFECTIVE DESIGN PROCEDURE, CREATING A STRONG LINEAR CORE NUCLEUS OF UNMATCHED ACCESSIBILITY.

R. BAILEY M.T.P.I.C., P. Eng., Commissioner of Planning and Secretary-Treasurer of the Planning Board
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C.B.D. TRANSIT SCHEME 6



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SCHEDULE

1.S6

Subsection 1.6

INTEGRATION AND DEVELOPMENT

GENERAL

The interaction between rapid transit and other circulation systems, and the effect of rapid transit on the grouping and intensity of development, are essential considerations of any proposed network alignment. Schedules 1-T1, 1-T2, and 1-T3 and the following text of this subsection consider these factors for three network proposals, with prime emphasis on the C.B.D. areas of each. These rapid transit alignments are shown superimposed upon a downtown general street layout which has been formulated in a separate study of the Central Area, and upon the metropolitan framework of existing and approved highways. (1.6.1)

The active C.B.D. will be framed by a collector street (Cannon) to the north and three widened, high-capacity arterials to the east (Victoria Avenue), south (Duke-Young), and west (Bay Street). Collector streets will penetrate this rectangle on each side, and will be internally linked by a loop road inside which only service vehicle and bus circulation will be permitted. By thus restricting through traffic, the C.B.D. gains most of the aspects of a pedestrian sanctuary. (1.6.2)

The metropolitan freeway loop will consist of the Q.E.W. (existing), Highway 403 (nearing completion), the Red Hill Creek Freeway (committed), and the Mountain Freeway (approved). The controversial East-West Freeway proposed for Lower Hamilton is purposely and conservatively disregarded, in the light of the great uncertainty surrounding its eventual realization. The freeway loop is augmented by Highways 2, 6, 8, and 20. (1.6.3)

PROPOSAL A

(Schedule 1-T1)

The rapid transit alignments depicted in Schedule 1.T1 are similar to those of Pattern 6 in Subsection 1.3, and of C.B.D. Scheme 6 in Subsection 1.5, except that a third line is integrated into the network. (1.6.4)

C.B.D. development arising from this layout would be elongated in an east-west direction. Intensive commercial development would centre on King Street, beneath which all three lines would run for a distance of some 3000 feet. At surface level, King Street would be converted into a broad pedestrian mall between James and Ferguson Streets. (1.6.5)

Two focal rapid transit stations would be located within this length of mall, one at Hughson Street, the other at Ferguson. The latter would be part of a major terminal complex, including office towers, parking space, and heliport, set at the eastern end of the mall, inside, and facing upon the service loop road. (1.6.6)

The terminal complex would integrate rapid transit with regional commuter rail (Go-Train) and possible hovercraft services, routed through the central city on a depressed right-of-way along Ferguson Street, which presently carries surface rail facilities. The terminal is also centred between the collector streets King William and Main, with north-south distribution readily available via Victoria Avenue for the convenience of both local and regional buses, as well as private automobiles. (1.6.7)

Although both commuter rail and hovercraft networks shall properly be the subjects of separate study, preliminary proposals have been set forth to illustrate their compatible integration with rapid transit in the city core. Their access and exit routes are further indicated over the metropolitan area. In this instance, commuter rail service is aligned on or adjacent to the C.N. trunk line between Burlington and central Hamilton. Scheduled hovercraft from Toronto ply across the harbour and make land near the North End. Both services use Ferguson Street as a venue to the base of the escarpment, whence they bear eastward in tandem on the T. H. & B. right-of-way. Hovercraft gains access to the Mountain, and the central and southern plateau, via the Red Hill Creek Valley, while commuter rail follows the T. H. & B. eastward toward Grimsby. (1.6.8)

Each of the six rapid transit branches has at least one major interchange station located on the suburban and regional highway network, as indicated on Schedule 1.T1, at which motorists commuting into the city may stop and park, then transfer to rapid transit for the remainder of their journey into the city centre. These interchange nodes of dual-mode accessibility are logical sites for suburban retail commercial complexes, with attendant free parking for both shoppers and rapid transit users. (1.6.9)

Other transit stations, especially those coinciding with or adjacent to the planned centres of communities, will become the natural centroids of new high-rise multiple dwelling clusters and their ancillary commercial and cultural development. (1.6.10)

PROPOSAL B

(Schedule 1-T2)

Proposal "B" basically represents Pattern 8 of Subsection 1.3, whose three lines of rapid transit intersect one another five times, with the object of producing a maximum degree and distribution of integral accessibility, within the core area's limiting confines. (1.6.11)

Here, rapid transit would induce C.B.D. development not in a linear form, but in a compact arrangement with generally closer internal ties. The dense commercial area would extend from Cannon to Young between James and Catharine Streets, projecting as well to the west of James Street into Civic Square. (1.6.12)

The three rapid transit intersection stations in this commercial area would be interconnected and linked to Civic Square by a pair of mutually bisecting pedestrian malls or decks on King and Hughson Streets. The two other intersection stations serve areas of civic, institutional, and mixed land use: one on Bay Street at City Hall, the other on James Street South at St. Joseph's Hospital. (1.6.13)

The site of the T. H. & B. railway station at Hunter and Hughson Streets would be suitable for the development of a multi-mode terminal complex. This location is, however, one city block south of the rapid transit intersection at Hughson and Jackson Streets. The problem may be partially offset by shifting the Hughson Street leg of the transit

station south until it forms a T with the Jackson Street leg, and by extending the terminal superstructure northward as far as Jackson Street. Nevertheless, there is still some inconvenience in transferring from the regional to local transportation scales. (1.6.14)

Commuter rail service might be aligned on widened C.N. and T. H. & B. railway rights-of-way, entering the central city from the Chedoke Valley on the west. From the harbour, hovercraft might enter the core via a depressed Catharine Street alignment, swing west beneath Hunter to parallel the commuter rails as they pass through the terminal complex, then continue towards the top of the escarpment adjacent to Highway 403. (1.6.15)

A number of possible highway-rapid transit interchange locations are shown on Schedule 1-T2, dependent upon the provision of adequate parking facilities. Also indicated are the areas of potentially dense development, surrounding rapid transit stations located in other than industrial zones. (1.6.16)

PROPOSAL C

(Schedule 1-T3)

Proposal "C" is a refinement of Pattern 7 in Subsection 1.3. The alignment details vary, but the branch relationships and the principle of three lines intersecting at three nodes are the same. (1.6.17)

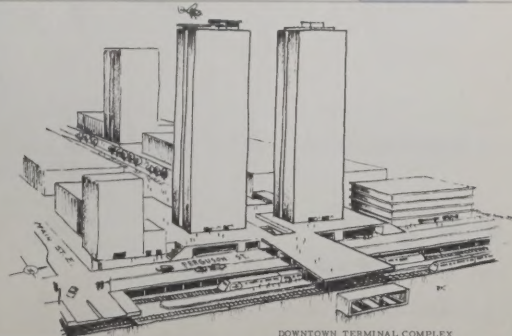
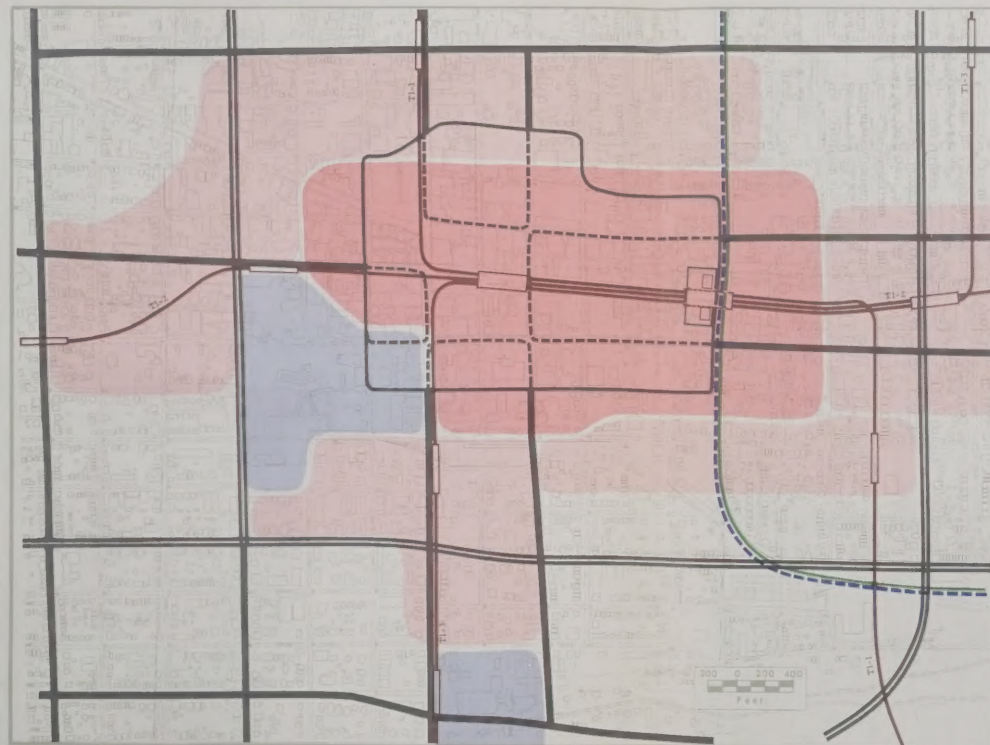
Commercial development would tend to group itself densely on a compact north-south axis through the two Hughson Street intersection stations. Immediately surrounding this area on three quadrants would be mixed commercial and residential, as well as civic and institutional, land uses. The fourth quadrant, to the southwest, might best be devoted to exclusive, high-density residential uses, which already have a strong foothold in this area. (1.6.18)

Regional commuter rail service again might follow existing railway alignments as indicated in Proposal "B". Hovercraft may also parallel this alignment between Coote's Paradise and Red Hill Creek. A transportation terminal on this alignment, at Hunter and Hughson Streets, will effectively integrate these regional travel modes with a rapid transit node for local distribution, augmented by surface vehicle access for buses, taxis and private automobiles, and by parking facilities for the latter. (1.6.19)

Transportation integration is further achieved by means of rapid transit interchanges with major arterials and collectors throughout the city, and with the converging highways on the city's outskirts. (1.6.20)

The extension of rapid transit service to outlying airports, such as Mount Hope, is generally excessive and unwarranted for any but the most bustling of intercontinental air terminals. (1.6.21)

The significant added value, in terms of accessibility, to land adjacent to rapid transit accesses, will be the principal cause of considerable new or renewed development in the paths of rapid transit alignments. Such development may be directed to coincide with presently dense groups and future community foci, as illustrated in Schedule 1.T3. (1.6.22)



DOWNTOWN TERMINAL COMPLEX

CENTRAL HAMILTON

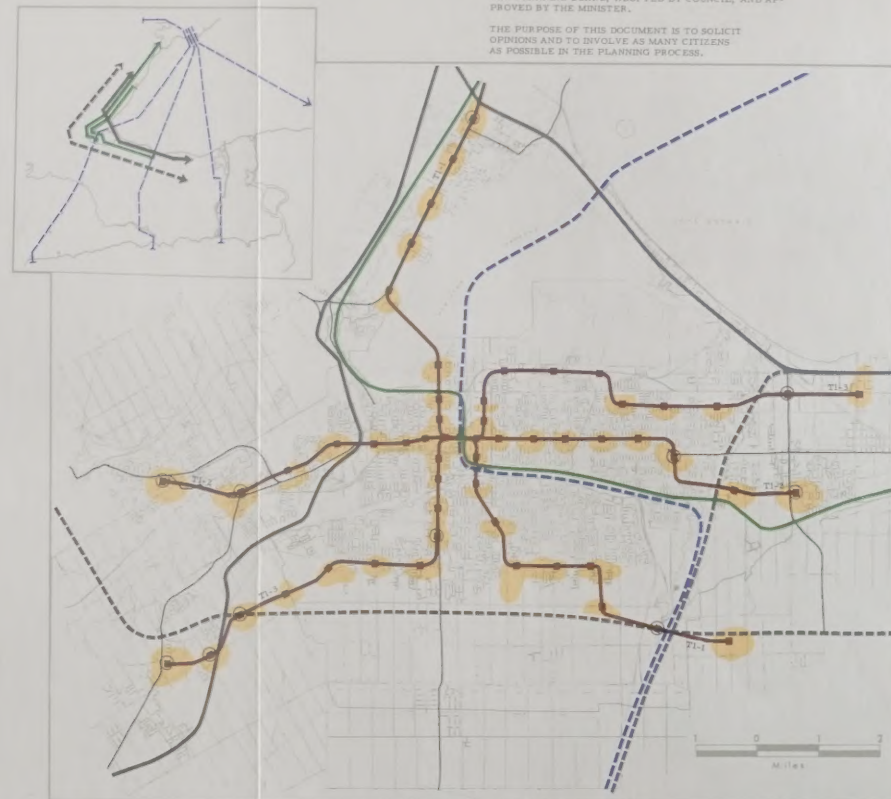
TRANSPORTATION	
MAJOR ARTERIAL STREET	—
MINOR ARTERIAL, MAJOR COLLECTOR	- - -
SERVICE LOOP ROAD	—
BUS LOOP	—
RAPID TRANSIT ALIGNMENT	—
RAPID TRANSIT STATION	—
COMMUTER RAIL (GO-TRANSIT) ALIGNMENT	—
HOVERCRAFT ALIGNMENT	—
MULTI-MODE TERMINAL	—
LAND USE	
INTENSIVE BUSINESS AREAS	Red
MIXED BUSINESS AND HIGH-DENSITY HOUSING AREAS	Blue
CIVIC AND INSTITUTIONAL AREAS	Grey

METROPOLITAN HAMILTON

TRAVEL MODE	
RAPID TRANSIT	—
EXISTING FREEWAY	—
PROPOSED FREEWAY	- - -
EXISTING HIGHWAY	—
PROPOSED COMMUTER RAIL	—
PROPOSED HOVERCRAFT	—
TRANSIT INTERCHANGE WITH	
BUSES, PEDESTRIANS	—
HIGHWAY MOTORISTS	—
BUSES, PEDESTRIANS	—
RAIL COMMUTERS	—
HOVERCRAFT PASSENGERS	—
BUSES, PEDESTRIANS	—
DEVELOPMENT	
AREA OF DIRECT INFLUENCE BY RAPID TRANSIT (IN NON-MANUFACTURING AREAS)	—

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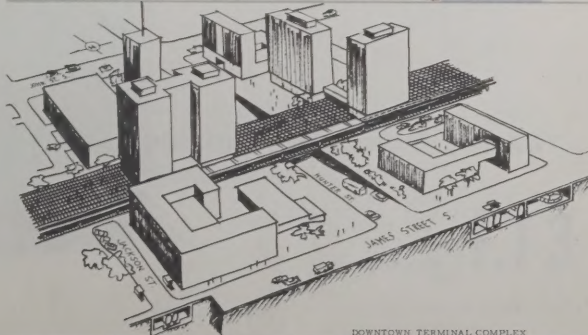
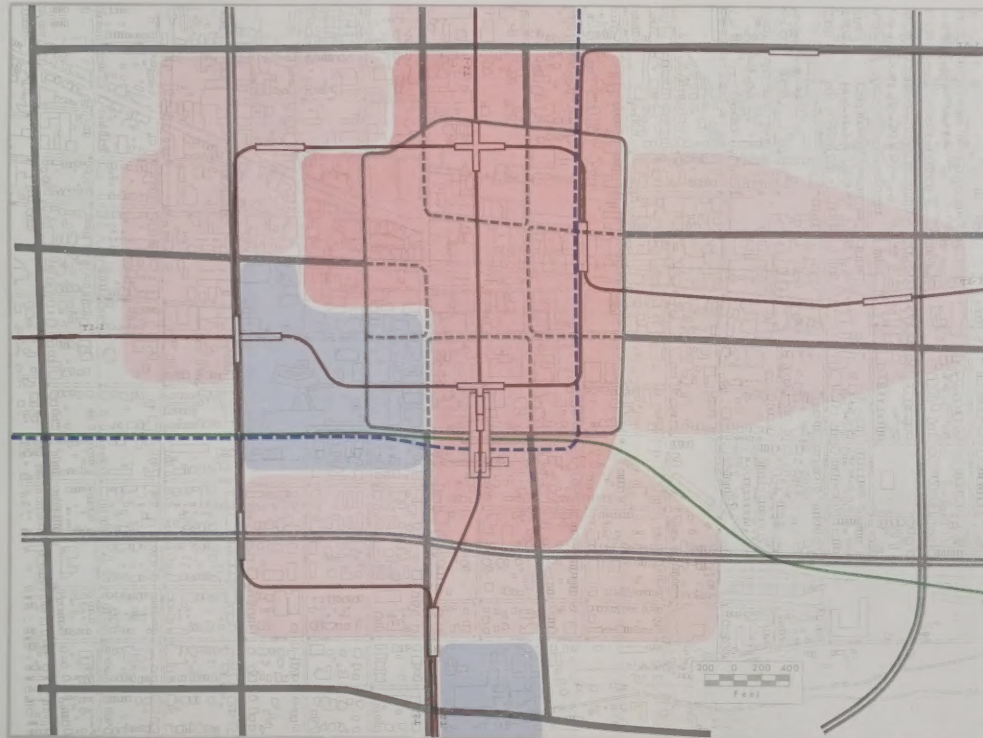


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INTEGRATION AND DEVELOPMENT: PROPOSAL A

SCHEDULE

1.T.1



CENTRAL HAMILTON

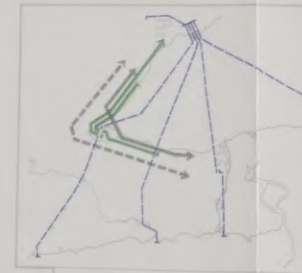
TRANSPORTATION

- MAJOR ARTERIAL STREET.....
- MINOR ARTERIAL, MAJOR COLLECTOR.....
- SERVICE LOOP ROAD.....
- BUS LOOP.....
- RAPID TRANSIT ALIGNMENT.....
- RAPID TRANSIT STATION.....
- COMMUTER RAIL (GO-TRAIN) ALIGNMENT.....
- HOVERCRAFT ALIGNMENT.....
- MULTI-MODE TERMINAL.....
- LAND USE
- INTENSIVE BUSINESS AREAS.....
- MIXED BUSINESS AND HIGH-DENSITY HOUSING AREAS.....
- CIVIC AND INSTITUTIONAL AREAS.....

METROPOLITAN HAMILTON

TRAVEL MODE

- EXISTING FREEWAY.....
- PROPOSED FREEWAY.....
- EXISTING HIGHWAY.....
- PROPOSED COMMUTER RAIL.....
- PROPOSED HOVERCRAFT.....
- TRANSIT INTERCHANGE WITH
- BUSES, PEDESTRIANS.....
- HIGHWAY MOTORISTS, BUSES, PEDESTRIANS.....
- RAIL COMMUTERS, HOVERCRAFT PASSENGERS, BUSES, PEDESTRIANS.....
- DEVELOPMENT
- AREA OF DIRECT INFLUENCE BY RAPID TRANSIT (IN NON-MANUFACTURING AREAS).....

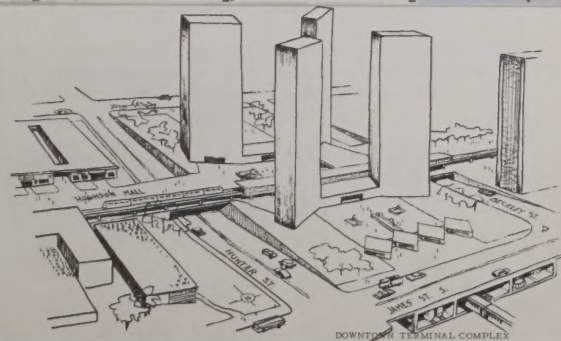
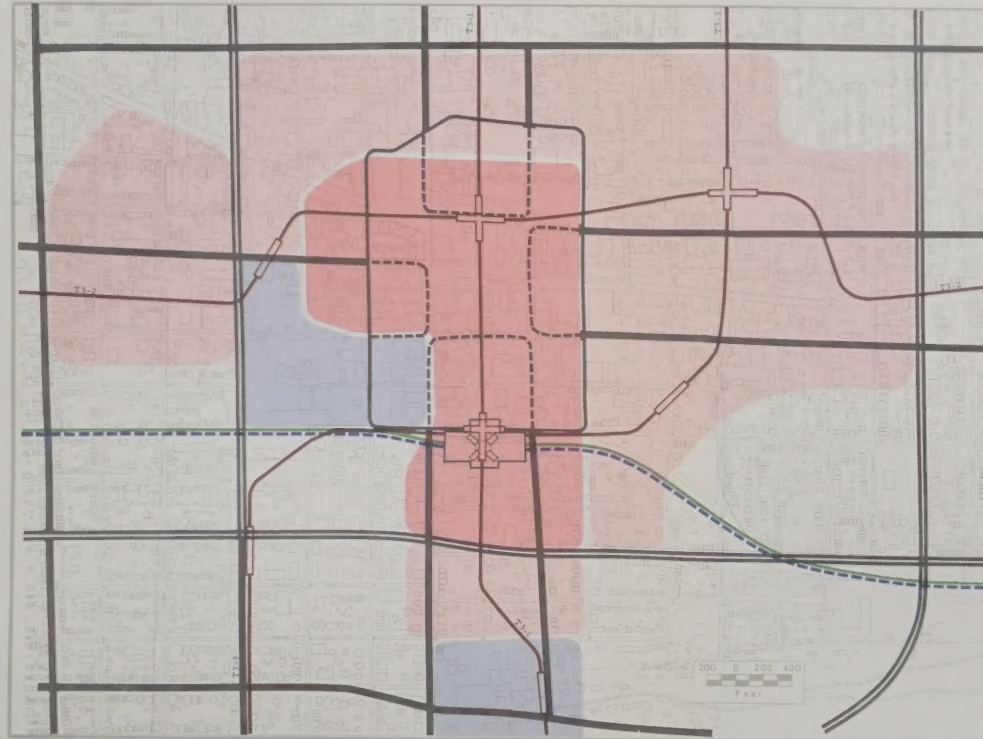


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INTEGRATION AND DEVELOPMENT: PROPOSAL B

SCHEDULE

1.T2



CENTRAL HAMILTON

TRANSPORTATION

MAJOR ARTERIAL STREET	—
MINOR ARTERIAL, MAJOR COLLECTOR	—
SERVICE LOOP ROAD	—
BUS LOOP	—
RAPID TRANSIT ALIGNMENT	—
RAPID TRANSIT STATION	—
COMPUTER RAIL (GO-TRAIN) ALIGNMENT	—
HOVERCRAFT ALIGNMENT	—
MULTI-MODE TERMINAL	—

LAND USE

INTENSIVE BUSINESS AREAS	—
MIXED BUSINESS AND HIGH-DENSITY HOUSING AREAS	—
CIVIC AND INSTITUTIONAL AREAS	—

METROPOLITAN HAMILTON

TRAVEL MODE

EXISTING FREEWAY	—
PROPOSED FREEWAY	—
EXISTING HIGHWAY	—
PROPOSED HIGHWAY	—
PROPOSED HOVERCRAFT	—

TRANSIT INTERCHANGE WITH

BUSES, PEDESTRIANS	—
HIGHWAY MOTORISTS	—
BUSES, PEDESTRIANS	—
RAIL COMMUTERS	—
HOVERCRAFT PASSENGERS	—
BUSES, PEDESTRIANS	—

DEVELOPMENT

AREA OF DIRECT INFLUENCE BY RAPID TRANSIT (IN NON-MANUFACTURING AREAS)	—
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DRAFT OFFICIAL PLAN 1976 OF THE CITY OF HAMILTON

INTEGRATION AND DEVELOPMENT: PROPOSAL C

SCHEDULE **1.T3**

Subsection 1.7

PHYSICAL CHARACTERISTICS AND PHASING

PHYSICAL CHARACTERISTICS

TYPE AND ELEVATION

A restrictive specification of any design details would be premature and would not be within the context of this Draft Official Plan. Precise alignments and elevations and the alternate types of rolling stock and guideway will be the subjects of separate future studies. (1.7.1)

Regardless of type, however, rapid transit must be completely free and unimpeded by other travel modes, and therefore is restricted to avenues of possible vertical or horizontal segregation. Rapid transit may be routed above grade in the form of monorail, elevated or sky-bus; or below grade by means of open cut, cut and cover, or tunnel. At-grade alignments generally require the circumvention of developed areas and the discontinuation or grade separation of intersecting rights of way. Table 1.1 lists the comparative construction costs of various grade alignments and facilities. (1.7.2)

Factors which influence the type and elevation of a rapid transit system may include capacity, speed, switching facilities, slope allowance, platform design, exposure, pollution, maintenance, capital cost, soil mechanics and aesthetics. (1.7.3)

An optimum network design may incorporate various grade alignments and transition zones according to the different local environments contained within the network service area. (1.7.4)

The angle of incline, or gradient, through such transition zones and in all other areas of elevation change is of course restricted. Employing flanged wheels and steel rails, the gradient is restricted to 3%. Vehicles with rubber-tired wheels are limited to a 6% gradient. A 300 foot rise, such as Hamilton's Escarpment, would require a sloping run one to two miles long. (1.7.5)

STATION SPACING

Planning Considerations

The coincidence of rapid transit access points, or stations, and nodes of development concentration, or density centres, is an obvious and critical objective. In this manner, the greatest possible number of people benefit from the transit service. Thus, it is not only important that a rapid transit line pass through the major high density nodes located in its corridor, but it is even more imperative that stations be distributed or spaced along the line coincidentally with the existing and/or future planned density nodes. (1.7.6)

Where the concepts of neighbourhood and community development are well established, station spacing should principally be governed by, and coincident with, the spacing of community centres. If this spacing is too great, further stations may well be provided upon the intervening stretches, according to the local density distribution or destination characteristics, and probably with concern to operational considerations. (1.7.7)

In areas and corridors of the city where the existing urban fabric lacks a clear definition of neighbourhood-community structure, development densities are generally concentrated along the major arterial streets, some arterials more than others depending upon the history and geographical peculiarities of the city. Transit station spacing under these conditions ought therefore to match closely the spacing of arterials both to capitalize upon the high density ridership potential and to facilitate easier and more numerous trip interchanges with vehicular traffic. (1.7.8)

Station spacing will also be affected and altered by the provision of access points, as may be deemed necessary or desirable, to various individual destinations of significance which do not conform to the generalized pattern of density nodes. An exhibition ground, stadium, arena, university, or hospital might, among others, constitute such a destination. (1.7.9)

Figure 1.3 : Elevations of rapid transit

ELEVATED MONORAIL (Seattle)

May be integrated with second level pedestrian decks and building entrances. No conflict with ground level travel modes. Support system takes up little ground right-of-way. It is however, visually intrusive, particularly in the C.B.D.



ELEVATED DUORAIL (Toronto)

Same general characteristics as the monorail. Aesthetically more disruptive due to bulkier structure. Slightly higher capacity. Undesireable in densely developed areas.



SURFACE LEVEL (Chicago)

Takes up considerable land. Conflicts with ground level pedestrian and vehicle rights-of-way, requiring multiple overpasses. Best suited to outer city areas of low density development. Intrusion is minimized when located upon expressway medians, where such exist.



OPEN CUT (Toronto)

Improvement over surface level alignment, although land requirements are similar. Partly screened from view, with confined noise contamination. Overpasses remain at or near grade level for pedestrians and automobiles.



SUBWAY (Montreal)

Aesthetically and functionally superior to all other levels of rapid transit alignment, but also the most costly. Virtually no conflicts - physical, visual, audible or climatic. Ideal for city centre. May be integrated via a network of underground pedestrian concourses with major offices, theatres, commercial complexes, rail and bus termini, etc.



Operational Considerations

The nonuniform spacing of consecutive stations can be expected to have a disruptive influence upon desirable smooth scheduling and constant headways, in a given corridor segment. The frequency of service may be too great at some stations and inadequate at others. For maximum operational efficiency through any corridor of generally consistent ridership demand, the station spacing should vary only slightly and within an optimum defined range. In practice, it has been found that the best urban rapid transit systems are based upon a core station spacing of $1/4$ to $1/3$ mile, a general urban area spacing of about $1/2$ miles, and suburban station intervals of up to 1 mile or more. It is not by any coincidence that the latter two spacings closely approximate the diameters of average sized neighbourhoods and communities, respectively. (1.7.10)

If the running speed between stations could be maintained at a constant, the only effect that station spacing would have on the overall system would be the total number of stops and the corresponding total station delay time for loading and unloading, per mile of alignment. Acceleration and deceleration however make constant speed an operational impossibility, and have a reducing effect upon average speed between stations. This average speed reduction becomes increasingly pronounced as the distance between station stops becomes smaller, that is, as acceleration and deceleration constitute an increasingly large percentage of the total travel time. (1.7.11)

Table 1.2 lists the running speeds between stations, and the average overall speeds, of conventional and high speed steel rail systems with station spacings ranging from $1/4$ to 2 miles. It may be seen that the average overall speed is approximately doubled when the station spacing is increased from $1/4$ to 1 mile; in other words, travel time is halved. (1.7.12)

In the core area, or C.B.D., the delays caused by the close spacing of stations have a centralization effect. Such centralizing power can be a strong factor in establishing the dominance of the C.B.D. Elsewhere, spacing ought to be increased to reflect lower accessibility and frequency requirements and to maximize the speed of travel. Maximum spacing of transit stops will occur on the urban fringe and in the suburbs, where population densities are relatively low. (1.7.13)

PHASING

As already indicated, there appear to be five outstanding corridors of desirable rapid transit initiation. Since the task of constructing a full network all at once is too overwhelming, particularly the financing of such a task, phasing will therefore have to be an essential consideration. (1.7.14)

Unforseeable changes in values and priorities during the forthcoming years will undoubtedly precipitate continual revisions of an overall phasing programme. A definite policy should be established at this time, however, with regard to the first phase. It is of critical importance, because its effectiveness in use will be the basis of judgment on whether to continue with successive phases of rapid transit. (1.7.15)

The first phase should be located in a corridor, or corridors of probable highest demand; that is, where travel volumes are greatest or are approaching capacity, and where population is densest. The results should be a maximization of transit ridership and, as a corollary, a maximum reduction in automobile traffic volumes and accidents. (1.7.16)

The corridors from the east and central Mountain down to Lower Hamilton, and from the C.B.D. east through Lower Hamilton to Stoney Creek, exhibit these characteristics to the greatest degree, as corroborated by the recent past and forecast statistics of H.A. T.S. (1961) and M.T.A.R.T.S. (1964). These corridors further contain the areas of planned development expansion, as specified in Amendment 228 (1967) to the existing Official Plan, and may be extended to include the southeast site of the 70,000 inhabitant satellite city proposal, Saltfleet New Town, atop of the Escarpment overlooking Stoney Creek, (1.7.17)

The first phase of implementation ought, therefore, to coincide with a major portion of either or both of these two corridors. (1.7.18)

TABLE 1.1

COST OF CONSTRUCTION FOR VARIOUS TYPES OF TWO-TRACK
RAIL-RAPID TRANSIT FACILITIES (1959 - 1960 PRICES)

Type of Facility	COSTS IN THOUSANDS OF DOLLARS	
	Average Cost Per Route Mile ¹	Cost Range For a Station ²
Cut and Cover Subway	9,900 - 17,800 ³	420 - 2,400
Tunnel	15,300	--
Elevated	3,200	480 - 720
Open Cut	2,600	400 - 600
Surface Level	2,100	320 - 480
Escalators (Each)	--	32 - 40

1. Includes costs of track and structures, relocation and maintenance of utilities, power supply and distribution systems, transmission and signal systems. Right-of-way costs and costs of engineering and contingencies are not included.
2. These costs are for stations that accommodate trains up to 600 feet long. The wide range in costs reflects variations attributed largely to whether single-or multi-level arrangements are used.
3. The wide range in costs is due in part to variations in soil condition, costs of underpinning, etc.

Source: "The Technology of Urban Transportation": Berry, Blomme, Shuldiner, and Jones. Northwestern University Press, 1963

TABLE 1.2

OPERATING SPEEDS FOR RAIL-RAPID TRANSIT EQUIPMENT

BASED ON CHICAGO TRANSIT AUTHORITY DATA, -- 1962

Station Spacing	Running Speeds MPH (Excluding Stops)		Avge. Overall Speeds, MPH (Incl. 15 sec. sta. stops)	
	Conventional ¹	Hi-Speed Car ²	Conventional	Hi-Speed Car
1/4 mile	21.2	25.6	15.6	17.9
1/2 mile	27.5	32.6	22.4	25.6
1 mile	33.9	41.0	29.6	35.0
2 miles	40.0	51.6	36.9	46.6

1 Top speed about 50 MPH

2 Top speed about 78 MPH

Source: "The Technology of Urban Transportation": Berry, Blomme, Shuldiner, and Jones. Northwestern University Press, 1963.

Subsection 1.8

DESCRIPTION OF SCHEDULES

SCHEDULE 1-P

Schedule 1-P illustrates the application of five principles of geometric configuration for a rapid transit network, on a schematic base map representing the dominant physical features of the Hamilton area.

SCHEDULE 1-Q

Schedule 1-Q presents a graphical comparison of the selected eight general pattern alternatives discussed in Subsection 1.3 of this Article Two of the Draft Official Plan.

SCHEDULES 1-R1 TO 1-R5

Each of these five schedules illustrates possible alignments, as described in the text of Subsection 1.4, of rapid transit in one of the five corridors into which the metropolitan area is divided, for the purposes of this Article.

SCHEDULES 1-S1 TO 1-S6

These six schedules present characteristic arrangements of two to three lines of rapid transit, showing how they may intersect in the Central Business District. Each C.B.D. rapid transit scheme is commented upon in the text of Subsection 1.5.

SCHEDULES 1-T1 TO 1-T3

The pattern of land use in the Central Area and the provision of modal interchanges are the chief characteristics shown on each of the three rapid transit networks presented in these three schedules.

SECTION TWO

P O L I C I E S

A general statement of planning policies, which together with Schedule 2-U, and in conjunction with Schedules 1-P, 1-T1 1-T2, 1-T3, 3-V, and 3-W, comprise the Official Plan.

Subsection 2-1

G E N E R A L

It is a necessary concern of this Draft Official Plan to examine the concept and likely implications of rapid transit. As never before, movement systems will be the dominant shaping factor in the evolution of larger and larger urban areas, and will control the effectiveness of future life patterns in the cities.
(2.1.1)

This Article Two of the Draft Official Plan, represents a preliminary conceptual analysis and is principally a basis for discussion and crystalization of public expression and opinion. Accordingly, the policies which follow are basically conceptual, and shall be subject to the political and technical constraints arising from further investigation and consideration. (2.1.2)

Subsection 2-2

P O L I C I E S

1. It shall be the policy of the Council of the City of Hamilton to pursue the investigation of rapid transit--as well as alternate forms of mass public transportation--through the most effective and comprehensive means at their disposal, essentially in conjunction and co-ordination with other major parameters of urban development such as regional communications, alternative patterns of land use, the existing road network and proposed additions and improvements to same, population and employment distributions, and so forth. (2.2.1)
2. Subject to review, based on any contrary recommendations emergent from subsequent qualified planning and development studies or based on the well-founded objections or views of either the public or private sector, it shall be the policy of Council to promote safe, all-weather, mass (rapid) transit service through parts of the City and surrounding area according to the following sequence of importance: (2.2.2)
 - 2.1 To and from the Mountain area, not further south than Mohawk Road in the central Mountain and into the North End. (2.2.3)
 - 2.2 Across town in an east-west direction below the escarpment, passing through the C.B.D. (2.2.4)
 - 2.3 Extensions of the above services into the major suburban communities bounding the city, such as Burlington, Dundas, Saltfleet New Town, and Stoney Creek. (2.2.5)
 - 2.4 Through other areas of the City and Metropolitan Area according to future needs and development patterns, as shall be continually reassessed by qualified planning research and as may be reflected in the prevalent conditions at the time such extensions are contemplated. (2.2.6)

DRAFT OFFICIAL PLAN 1970 OF THE CITY OF HAMILTON
CITY OF HAMILTON PLANNING DEPARTMENT
March 1969, First Edition

SUBJECT TO REVIEW IT SHALL BE THE POLICY OF COUNCIL TO PROMOTE SAFE, ALL-WEATHER MASS RAPID TRANSIT IN HAMILTON ACCORDING TO THE FOLLOWING SEQUENCE OF PRIORITIES:

1. TO AND FROM THE MOUNTAIN AREA (NOT FURTHER SOUTH THAN MOHAWK ROAD IN THE CENTRAL AREA), THROUGH THE C.B.D., AND INTO THE NORTH END
2. ACROSS TOWN IN AN EAST-WEST DIRECTION BELOW THE ESCARPMENT PASSING THROUGH THE C.B.D.
3. EXTENSIONS OF NO. 1 INTO MAJOR SUBURBAN COMMUNITIES.
4. THROUGH OTHER AREAS OF THE CITY AND METROPOLITAN AREA ACCORDING TO FUTURE NEEDS AND DEVELOPMENT PATTERNS.

DESIRABLE FUTURE EXTENSION INTO BURLINGTON AS THE PRINCIPAL REGIONAL PARTNER OF HAMILTON.

ALL RAPID TRANSIT LINES TO GO DOWNTOWN (FIRST PRINCIPLE, SCH. 1, P)

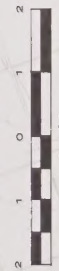
ACCORDING TO NEED, ADDITIONAL SERVICE LINES MAY BE ADDED TO COMPLETE THE NETWORK BALANCE, SUCH AS AN INDUSTRIAL SECOND BRANCH IN THE LOWER HAMILTON CORRIDOR.

EXTENSION OF SERVICE INTO DUNDAS CORRIDOR AND PERHAPS TO THE TOP OF THE ESCARPMENT.

LONG RANGE POSSIBILITY OF A WEST MOUNTAIN BRANCH, OUT TO ANCASTER, SUBJECT TO SUCCESSFUL IMPLEMENTATION OF PREVIOUS PHASE BRANCHES.

POSSIBLE EXTENSION INTO OUTER AREAS (E.G. STONEY CREEK) ACCORDING TO FUTURE DEMANDS.

EXTENSION EASTWARD CAN SERVE THE SATELLITE TOWN OF SALTFLEET



THIS PLAN IS **NOT** OFFICIAL, UNTIL RECOMMENDED BY THE PLANNING BOARD, ADOPTED BY COUNCIL, AND APPROVED BY THE MINISTER.

THE PURPOSE OF THIS DOCUMENT IS TO SOLICIT OPINIONS AND TO INVOLVE AS MANY CITIZENS AS POSSIBLE IN THE PLANNING PROCESS.

RAPID TRANSIT POLICIES

2.U

SCHEDULE

SECTION THREE

IMPLEMENTATION

A statement of the procedures to be followed in the implementation, interpretation and revisions of the Official Plan.

ACCESSIBILITY AS A TOOL OF IMPLEMENTATION

HORIZONTAL SCALE: 4400 FEET = 1 INCH

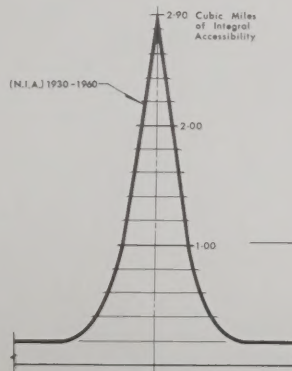


FIGURE 1 IN THE 19th CENTURY, THE CENTRAL BUSINESS DISTRICT OF HAMILTON DEVELOPED AT THE INTERSECTION OF MAJOR ROUTES FROM OUTSIDE THE CITY: HIGHWAY 8 FROM THE NIAGARA PENINSULA AND U.S.A., HIGHWAY 6 FROM THE MOUNTAIN AND AREAS TO THE SOUTH, AND YORK STREET FROM TORONTO. THIS POINT OF GREATEST ACCESSIBILITY BECAME REDFORCED BY THE INTERNAL TRANSIT SYSTEM OF HAMILTON AND RESULTED IN A CONE, OR ENVELOPE, OF NORMAL INTEGRAL ACCESSIBILITY BEING ESTABLISHED TO THE DEGREE ILLUSTRATED IN FIGURE

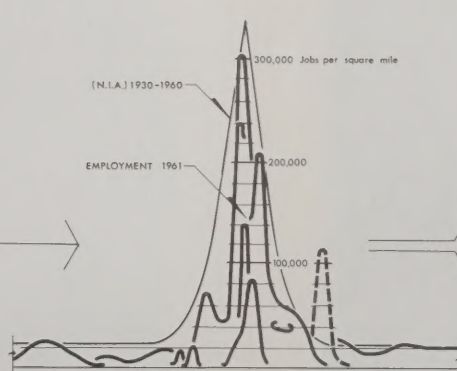


FIGURE 2 THIS CONE, OR ENVELOPE BECAME GRADUALLY FILLED WITH EMPLOYMENT AS COMMERCIAL AND LIGHT INDUSTRIAL FUNCTIONS BECAME CONCENTRATED WITHIN THE AREA OF HIGHEST ACCESSIBILITY IN THE CITY. FIGURE 2 ILLUSTRATES THE HIGH DENSITIES OF EMPLOYMENT THAT HAD BEEN ESTABLISHED BY 1961 AND HOW STRONGLY THIS DISTRIBUTION HAS BEEN CONCENTRATED WITHIN WALKING DISTANCE OF THE POINT OF HIGHEST ACCESSIBILITY. THE HIGHEST PEAKS ARE LOCATED IN THE BLOCK OCCUPIED BY THE LARGEST DEPARTMENT STORE, IN THE BLOCK WHERE THE LARGE BANKS HAVE BEEN ESTABLISHED, AND IN THE BLOCK OCCUPIED BY THE LARGEST HOTEL. THE PEAK SHOWN IN A BROKEN LINE IS THE HAMILTON CIVIC HOSPITAL, A CONCENTRATION OF EMPLOYMENT CREATED BY AN ADMINISTRATIVE DECISION AND THUS NOT TO THE SAME DEGREE SUBJECT TO THE FORCES OF "NATURAL ECONOMIC" SELECTION.

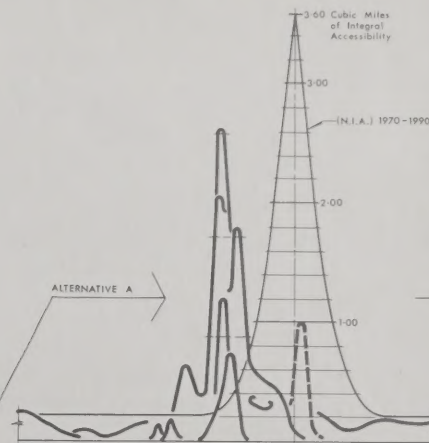


FIGURE 3. ILLUSTRATES THE SITUATION WHICH WOULD RESULT IF A NEW POINT OF STRONGER INTEGRAL ACCESSIBILITY WERE ESTABLISHED BY SOME FORM OF RAPID TRANSIT AT A POINT REMOVED FROM THE PRESENT HIGHEST PEAK OF EMPLOYMENT.

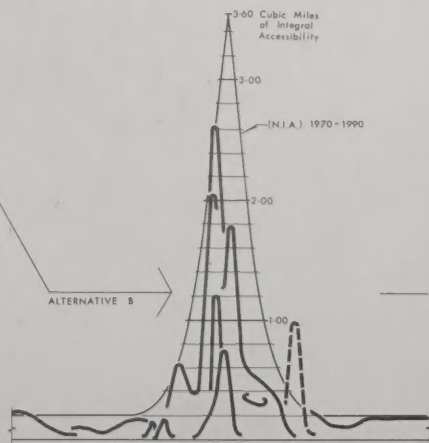


FIGURE 5. HERE IT IS ASSUMED THAT A NEW PEAK OF INTEGRAL ACCESSIBILITY IS CREATED APPROXIMATELY AT THE POINT OF THE PRESENT HIGHEST EMPLOYMENT DENSITY. NOW THE EFFECTS OF ACCESSIBILITY AND THE FORCES OF BUSINESS WORK IN HARMONY, MUTUALLY REINFORCING EACH OTHER

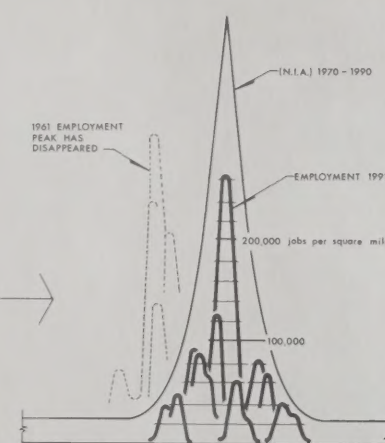


FIGURE 4. ILLUSTRATED HERE IS THE RESULT OF THE POWERS OF BUSINESS AND THE FORCES OF ACCESSIBILITY BEING OUT OF STEP FOR 20 YEARS. THE TWO FORCES WERE WORKING AGAINST EACH OTHER, TO THEIR MUTUAL DETRIMENT.

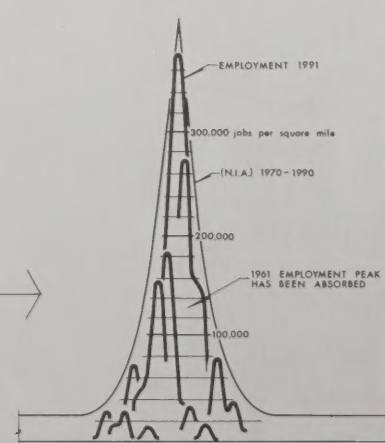


FIGURE 6. THE 20-YEAR DURATION OF THE HARMONY OF ACCESSIBILITY AND BUSINESS INTERESTS HAS NOW RESULTED IN A VIGOROUS CENTRE. THUS IN THE CONTEXT OF THIS SECOND ARTICLE OF THE DRAFT OFFICIAL PLAN 1979, TRANSIT IS MORE THAN JUST A SUPPLEMENTARY SERVICE. IT IS A POSITIVE MEANS FOR DIRECTING AND SHAPING URBAN GROWTH IN ACCORDANCE WITH COMMUNITY DEVELOPMENT GOALS.

Subsection 3-1

GENERAL

In order to define the meaning of Implementation, it is first necessary to understand the term Planning as it applies to the specific field of Transportation. Planning must be thought of in terms of "ING" - of going, never ending, always studying analysing, appraising and reporting on what has gone on, is going on and what could go on. Anyone associated with Planning knows that it is never static, but always dynamic, a continuous process. (3.1.1)

Yet, within this process of Planning, decisions have to be made which define a specific project and permit it to be spun out from the Wheel of Planning, designed and constructed. Implementation is therefore this action of spinning out specific projects from time to time, and transforming them from the theoretical to the physical. (3.1.2)

The action must first start inside the planning envelope where there would be an interdisciplinary technical body, objective in its outlook, deciding the priority of projects. The priority should be established with a knowledge of cost-benefit analysis and the availability of funds. This technical body should also aid in the details of the project to ensure maximum benefits from each project. (3.1.3)

At regular intervals in the future the planning process is repeated and the projects up-dated to take into account the changes in development and technological advances which have occurred in the interim period. The approach described in the introduction of Subsection 3-2 is referred to as the "minimum regret approach" to planning since it tries to make as few mistakes as possible in a rapidly changing environment by retaining as many desirable options as possible for as long as possible while continuing to move ahead on plan implementation. (3.1.4)

Subsection 3-2

IMPLEMENTATION

Introduction

Within the span of the next fifteen years, the issue of rapid transit for Hamilton is a purely political question. Five points ought to be borne in mind however: (3.2.1)

1. Since demand for transportation services is dependent upon the distribution of land uses and urban activities, any proposed transport system must be tied to a specific land use development plan. (3.2.2)
2. Transport systems as well as other public service systems exert a strong influence upon development. The land use development plan must therefore be compatible with the transport plan to the extent that the development forces set into motion by the transport system should tend to produce the very development patterns advocated by the land use plan. (3.2.4)
3. Also the land use plan ought to contain forms and densities of urban centres and residential communities such that the private and public components of the transport system can effectively serve it. (3.2.5)

4. Implementation of the plan requires the formulation of a step by step implementation program illustrating the schedule of all actions, the organization required and the planning of financial resources. (3.2.6)
5. The final Official Plan should therefore show which alternative plans are also feasible: it should be made clear in describing the procedure of implementation which major steps are compatible with the most preferred two or three alternative plans, so that the decision makers can determine at any time the degree of flexibility which is retained after each major decision. (3.2.7)

Official Plan

The Official Plan shall be implemented by Council under powers conferred upon it by The Planning Act and The Municipal Act and any related legislation insofar as it relates to planning. The senior levels of government and authorities shall be encouraged to support the objectives. (3.2.8)

Secondary Plans and Zoning

The existing Zoning By-law will be completely reviewed each 5 years approximately in accordance with the intent and objectives of the Official Plan. When a Secondary Plan for a residential neighbourhood is approved and incorporated into the Official Plan, the Zoning By-law will also be reviewed. So the Official Plan is looking 20-40 years ahead, the Secondary Plans are looking 5 years ahead, the Zoning By-law deals with the present. (3.2.9)

Financing

Council will direct the preparation of a Capital Works Program covering a period of from three to five years. This program will conform to the general objectives of the Official Plan, taking into account the ability of the municipality to finance, in conjunction with negotiated federal and/or provincial subsidies, the implementation of the provisions of this Plan. (3.2.10)

Urban Renewal Schemes

Where applicable, particularly in the older areas of Lower Hamilton the provisions of this plan shall be implemented through established urban renewal procedures. Where feasible, urban renewal shall be synchronized with the Official Plan. (3.2.11)

PROCEDURE

- 1.1 If and when it is decided that Hamilton is to embark upon rapid transit, and following the completion of the Draft Official Plan document of which this article is a part, a Rapid Transit Committee hereinafter referred to as the Committee, shall be appointed by Council. (3.3.1)
- 1.2 This Committee will consist of two elected officials and of representatives from various concerned City Departments including the Planning Department, the Traffic Department, and the Hamilton Street Railway Company (3.3.2)
- 1.3 This Committee shall deal with plans, proposals, investigations and other aspects relating to rapid transit, and shall determine appropriate courses of action on same for recommendation to Council. (3.3.3)
- 2.1 The Committee shall guide the development and adoption through Council, of an optimum final plan for rapid transit. The final plan shall be developed taking into full consideration: (3.3.4)
 - 2.1.1 the reactions of the public sector to all publicized plans and proposals dealing directly or indirectly with rapid transit. (3.3.5)
and
 - 2.1.2 the policies for long-range development and land use, as set down in the body of the Draft Official Plan, or an approved Official Plan for the City of Hamilton, and its subsequent amendments. (3.3.6)
and/or
 - 2.1.3 the findings and recommendations of any provincially backed comprehensive planning and development studies, either regional or urban in character, of the Hamilton Area. (3.3.7)
- 2.2 If, as a result of its considerations over a period of time, the Committee shall finally conclude that, for one reason or another, no rapid transit system is suitable or viable in Hamilton, the Committee shall so advise Council. (3.3.8)

- 3.1 The Committee shall otherwise seek to gain approval of a final plan for rapid transit, considerably in advance of the first stages of design or construction, to ease the difficulties and costs of eventual implementation by allowing preparatory measures to be taken over a period of time. This period of adjustment, perhaps in the order of ten to twenty years, will provide municipal authorities and planners the opportunity to: (3.3.9)
- 3.1.1 protect the right-of-way alternatives in each corridor by preventing or controlling any new development which may threaten or infringe upon, or may be considered incompatible with, these rights-of-way (subject to a clarification of the legislation regarding municipal rights and powers to freeze development in corridors, and the nature of consequent compensations). (3.3.10)
- 3.1.2 relocate various utilities, such as gas and water mains storm and sanitary sewers, buried cable, etc., as these utilities come up for reconstruction or replacement, so as no longer to conflict with the future rapid transit rights-of-way. (3.3.11)
- 3.1.3 commence an orderly redistribution of residential and employment densities by publicizing future intent re: rapid transit alignment and by revising the zoning by-law to permit higher density employment and housing areas to be developed along the alignments of the final plan. (3.3.12)
- 4.1 Once a final plan for rapid transit has been approved by the Minister and incorporated or amended into the Official Plan, and public acceptance of the Plan has been ascertained, applications shall be made to the Provincial and Federal Governments to qualify for financial subsidies to implement the approved rapid transit system. (3.3.13)
- 4.2 To qualify for federal funds Hamilton shall seek to establish itself as a Canadian model city, whose undertaking in rapid transit will serve as a demonstration project for all Canadian municipalities with similar ambition in mass public transportation. (3.3.14)
- 4.3 Cost-sharing arrangements agreed upon by the three levels of government--city, provincial and federal--shall apply to preliminary design studies and investigations as well as to purchase of rights-of-way for and the construction of, a rapid transit system. (3.3.15)

- 4.4 A programme of land acquisition for rights-of-way shall be established as soon as the final plan for rapid transit is approved. Such private land as is necessary shall be acquired as far in advance as possible, and in a continuing fashion from year to year (according to Capital Budget allocation), in an attempt to minimize the impact and disruption of mass relocation over a short period of time, and in order to better distribute and lighten the burden of the costs of such acquisitions. The acquired lands shall remain in use, under lease from the City, until such times as construction phases shall demand their clearance. (3.3.16)
- 4.5 If a satisfactory cost-sharing programme is not forthcoming, the City shall consider alternative forms of financing, such as a long-term loan from the Federal Government to be repaid with the added revenues from the increased assessments of properties adjacent to the rapid transit network, and from the sale of prepurchased lands and air rights contiguous to rapid transit nodes. (3.3.17)
- 5.1 Cost-benefit analyses and construction programme design studies shall in general be contracted out to specialist consultants with experience in the field of rapid transit. (3.3.18)
- 6.1 Construction of the final system shall be executing according to an established phase programme, which programme shall be co-ordinated with the availability of funds over time and with the schedule of urban renewal activities proposed for certain areas contiguous to the alignment of the system, if any. (3.3.19)
- 7.1 At such time as a rapid transit system, or part thereof, shall be completed and ready for operation, if such event should come to pass, the Rapid Transit Committee shall be dissolved and replaced by a Transit Commission, which Commission shall be responsible to Council. (3.3.20)
- 7.2 The Transit Commission shall assume and continue to pursue all planning functions and activities, in conformity with the Official Plan, which were formerly conducted by the Rapid Transit Committee, and shall in addition be responsible for the operation and maintenance of all public transportation facilities in the Metro Area, effectively superceding all municipal public transportation authorities in existence at that time. (3.3.21)

PLAN ADOPTION

IT IS THE INTENT AND PURPOSE OF THE DRAFT OFFICIAL PLAN 1970 OF THE CITY OF HAMILTON TO LISTEN AND TO LEARN, RATHER THAN TO LECTURE AND LAY DOWN THE LAW. (3.4.1)

This first division called RAPID TRANSIT of the second article, TRANSPORTATION, of the Draft Official Plan 1970, will be presented to the Planning Board at a public meeting early in 1970. If the Board accepts the article, the Board will hold a public meeting to fully explain to the public the policies and recommendations contained therein, and to distribute copies of sections two and three of the article. Copies of the complete article shall then be available at a nominal charge. (3.4.2)

At this meeting the chairman of the Planning Board will request written submissions from the public regarding this Article Two, Division One, "Rapid Transit" of the Draft Official Plan 1970. (3.4.3)

After written submissions are received, a public meeting shall be held of a full quorum of the Planning Board, to consider these submissions and to give considerations to changes of the plan arising out of these submissions. (3.4.4)

The RECREATION division of Article Three, CIVIC & SPECIAL USES, of the Draft Official Plan 1970 shall follow next. Further articles are being prepared together constituting the Draft Official Plan 1970 of the City of Hamilton. It is intended to employ a similar procedure with each one of the articles, and it is hoped that the bulk of these articles will be ready sometime toward the end of 1970. (3.4.5)

The next step will then be to put the pieces of the mosaic together, and the various articles may have to be amended perhaps even drastically, under circumstances, to dovetail all the functions considered simultaneously with each other. (3.4.6)

Thus a new Plan Document shall be formed about 1971 which will be a combination of all the parts, and which shall then be treated as a proposed new Official Plan of the City of Hamilton. (3.4.7)

DESCRIPTION OF SCHEDULES

SCHEDULE 3.V

Schedule 3-V illustrates the chain effects of alternative rapid transit foci upon accessibility and eventually upon the structure of land use. The height of 2.90 cubic miles of integral accessibility of the cone in Figure 1 was established by planimetering the areas contained within selected 1961 normal relative accessibility contours based on a range of 1/4 mile (see Appendix: "The Concept of Accessibility"). The cone was drawn to a range of 1860 feet. Further details of the employment distribution of Figures 2, 3, and 5 can be found upon the two employment maps in the Appendix. (3.5.1)

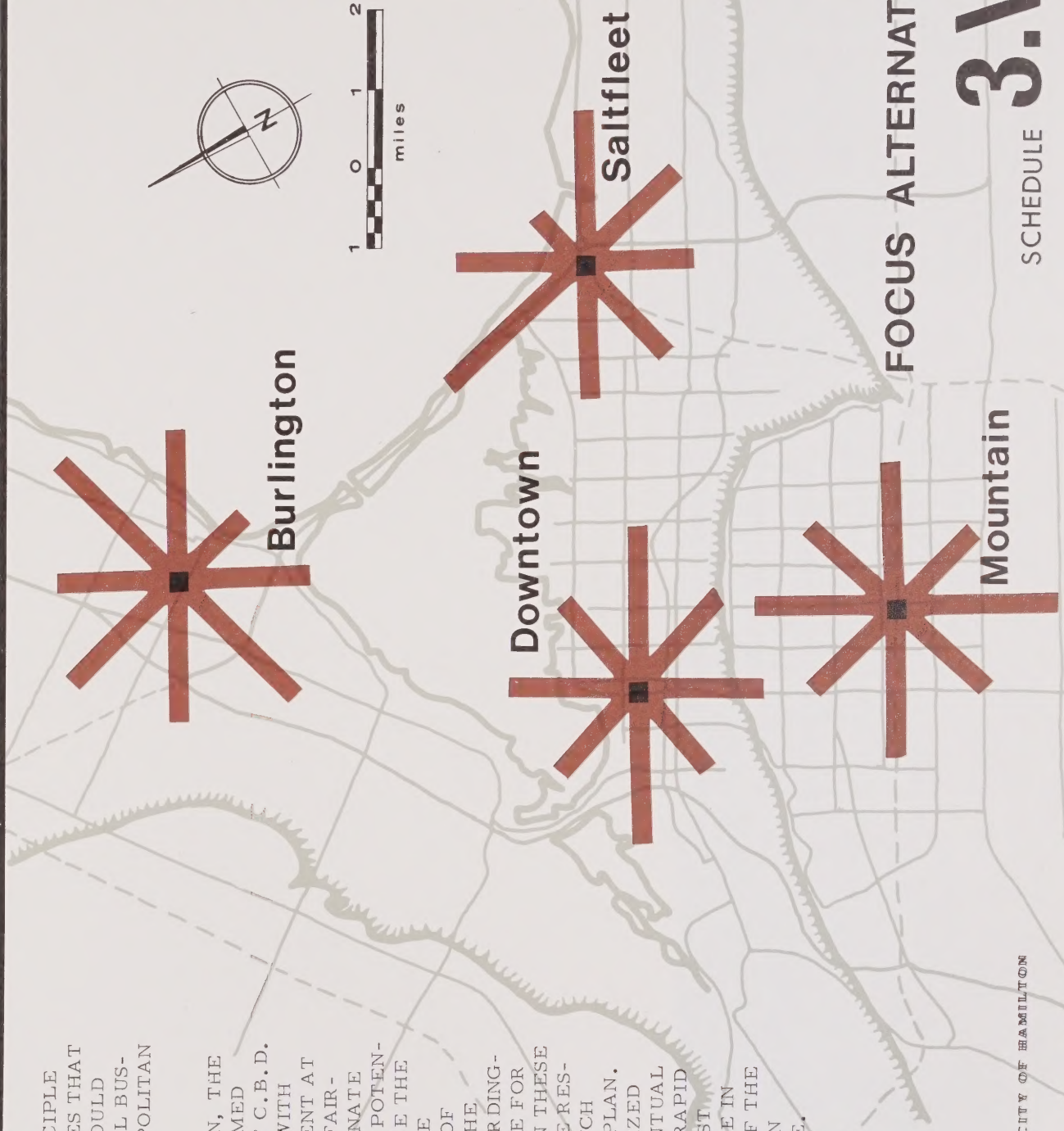
The height of the peak of normal integral accessibility of 3.60 cubic miles in Figures 3 and 5 has been arbitrarily selected as somewhat larger than the maximum integral accessibility now existing, and the positions of the peaks have been similarly selected for illustrative purposes in alternatives "A" and "B". As in Figure 1, the peak is again drawn to a range of 1860 feet. The employment densities which follow in Figures 4 and 6 have then been derived by multiplying the normal integral accessibility in various centroids by a set of random numbers. (3.5.2)

SCHEDULE 3.W

The four schematic intersections of Schedule 3-W represent not the exact locations but rather the general areas where consideration might alternatively be given to focusing a rapid transit system, in the Hamilton Area. A minimum length of 14 miles is required according to (1.2.14), to have the accessibilities of a line exercise their full effect. No reflections upon the number or arrangement of lines are meant to be inferred from the symbols. (3.5.3)

IT HAS BEEN STATED AS A PRINCIPLE AND SUPPORTED IN THE POLICIES THAT ANY RAPID TRANSIT SYSTEM SHOULD BE FOCUSED UPON THE CENTRAL BUSINESS DISTRICT OF THE METROPOLITAN AREA.

FOR THE PURPOSE OF THIS PLAN, THE FUTURE C.B.D. HAS BEEN ASSUMED COINCIDENT WITH THE PRESENT C.B.D. OF HAMILTON, IN AGREEMENT WITH POLICIES AND OPINION PREVALENT AT THIS TIME. THERE ARE IN ALL FAIRNESS, HOWEVER, THREE ALTERNATE GENERAL LOCATIONS WITH THE POTENTIAL TO GROW AND OUTDISTANCE THE EXISTING CORE, SHOULD FUTURE POLICIES DETERMINE ANY ONE OF THEM MORE DESIRABLE THAN THE C.B.D. WE HAVE TODAY. ACCORDINGLY, THERE IS CERTAINLY A CASE FOR STUDYING SYSTEMS CENTRED ON THESE ALTERNATE FOCI, THOUGH TIME RESTRICTIONS HAVE PREVENTED SUCH FROM BEING INCLUDED IN THIS PLAN. INDEED, IT SHOULD BE RECOGNIZED THAT THE SELECTION AND EVENTUAL IMPLEMENTATION OF A FOCAL RAPID TRANSIT PLAN WILL BE THE MOST DECISIVE POWER AND INFLUENCE IN DETERMINING TOWARD WHICH OF THE FOUR NODES FUTURE DOWNTOWN DEVELOPMENT WILL GRAVITATE.



APPENDIX

THE CONCEPT OF ACCESSIBILITY

Accessibility has been for years the missing link of town planning, the link between land uses and transportation. Hence it appears fit and proper to include here a few notes on the concepts of relative and of integral accessibility.

DEFINITIONS

The relative accessibility of two points is a measure of the degree of interconnection of the two points, that is, a measure of how accessible the two points are from each other.

The integral accessibility of a point is a measure of the amount of interconnection or contact that a point has with the rest of the world.

RELATIVE ACCESSIBILITY

We measure relative accessibility in percents. We say that the point we are in at a given moment is to us 100% accessible, that is, its relative accessibility (relative to itself) is 100%. For example, if we will speak of the relative accessibilities, relative to Burlington Beach on Lake Ontario, we will say that the relative accessibility of any other place in the world (relative to Burlington Beach) is a greater or smaller part of 100% according to whether it is easier or more difficult to get there from Burlington Beach. The reasons why some places might be less accessible from Burlington Beach are, of course, numerous. For example: time necessary to get there, cash involved, legal restrictions to travel or import, capacity of transport system, etc.

To the mathematical reader we can say that the relative accessibility is in principle a frequency function, with the mode in the point of departure or arrival. How do we get, in per cents, the relative accessibility of any two points, say from 'A' to 'B'? To ask what is accessible from 'A' has no meaning. All we can answer is, that today, in the 20th century, any point on our globe (and many a place beyond) is accessible from 'A'. It is an entirely different matter if we specify a range, say by asking what is accessible from 'A' within an hour. This question can be answered.

Thus we have to deal with two further subjects here and now - with distances shrinking along communications, and with the concept of a range.

NOTION OF SHRINKING DISTANCES

This is not a new concept. It has been known for some time that since the introduction of fast mechanized transport, distances have shrunk along communications, and our factor "L" tells us how much they have shrunk. If they have shrunk to half, our factor "L" is 2; if they have shrunk to one fifth, our factor "L" is 5, etc. (See Figure A-1)

The concept of the volume of accessibility under the accessibility surface (see "Integral Accessibility" on the following page), tacitly involves the notion of equivalence of the accessibility from large distant areas of low rel. acc., and of accessibility from small nearby areas of high rel. acc.. It assumes that 100 square miles 2% accessible each, have the same weight as 4 square miles 50% accessible each, and this in turn is only acceptable, if the principle of convergence of integral accessibility is adhered to, (a treatment of which is beyond the scope of this appendix). When the limits of this principle of convergence are disregarded, one finds that distant areas are given undue weight, and the effects of nearby areas of high accessibility are underestimated, and in a consequential analysis one always gets infinity for the integral accessibility of every point.

CONCEPT OF A RANGE

The concept of a range is also not very new. It has been known for a long time that phenomena often cover a certain range. The distance we can travel for recreation on a Saturday afternoon, the ranges of various aircraft types, the distance milk is delivered, the maximum trajectories of firearms, or the distances determined by the time and fares people are able and willing to afford for daily travel to work today, are some examples. We will reserve the letters "R" and "r" to denote range. Thus, whenever an "r₆" or "R₃" appears in our analysis, it indicates that a range is involved, no matter how camouflaged its existence or how involved its influence.

Thus, for example, the normal relative accessibility (N. R. A.)_{n,k} of the two points "n" and "k" is given by:

$$(N. R. A.)_{n,k} = \exp - \left[\left(\frac{a+c}{r_0} \right)^2 + \left(\frac{b}{Lr_0} \right)^2 \right]$$

or, in a different notation:

$$(N. R. A.)_{n,k} = e^{- \left[\left(\frac{a+c}{r_0} \right)^2 + \left(\frac{b}{Lr_0} \right)^2 \right]}$$

in which "L" represent the shrinkage factor upon distances along the line of transportation, "r₀" is the range of the pedestrian (without the line of transportation), "b" is the distance travelled along the line of transportation, and "a" and "c" are the distances from the line of transportation to points "n" and "k" respectively.

The ranges used in Figure 1-2, Section One, of this article Rapid Transit of the Draft Official Plan 1970, of the City of Hamilton, are 6 miles, 60 miles, 600 miles and 6,000 miles. We see that each one is ten times larger than the preceding range, and that the set of four ranges can cover the accessibility spectrum in equal steps, from a local scale to the largest Global size. The concept of a range is a cornerstone in any investigation into accessibility.

INTEGRAL ACCESSIBILITY

We are now prepared to calculate integral accessibility. This may be done by assuming the 100% relative accessibility mark on the vertical scale to be equivalent to a height of one mile, 50% relative accessibility equal to one half mile, and so forth. The contours of relative accessibility, relative to a point, will then form a three-dimensional hillock, called the accessibility surface (see Figure A.2). Other parameters being equal, the larger the volume contained beneath the hillock, the better the interconnection of this point with the surrounding region. Therefore, this volume is used as a measure of the interconnection of the point with the world at large. In fact, normal integral accessibility has been defined, since the late 1950ties, as the volume in cubic miles contained beneath the accessibility surface of a point. To the mathematical reader we can say that the integral accessibility of a point is essentially a scalar point function, defined by the integral of its relative accessibilities.

Integral accessibility in cubic miles:

$$N. I. A. = \int_{x=-\infty}^{-\infty} \int_{y=-\infty}^{-\infty} \int_{z=0}^{\exp -[(\frac{a+c}{r_0})^2 + (\frac{b}{Lr_0})^2]} dx dy dz$$

in which a, b, and c represent lengths of lines, or distances in the x-y plane.

Under circumstances, we will wish to compare patterns of integral accessibility. In these cases it will be often desirable to establish a comparative unit. We shall then select a measure in landmarks or in seamarks. The volume under the accessibility surface of the pedestrian range can serve as our standard, and we shall divide all the volumes by that measure. We will then say that a point has an integral accessibility of five landmarks for example. if the volume under its accessibility surface is five times the volume under the accessibility surface of the pedestrian range.

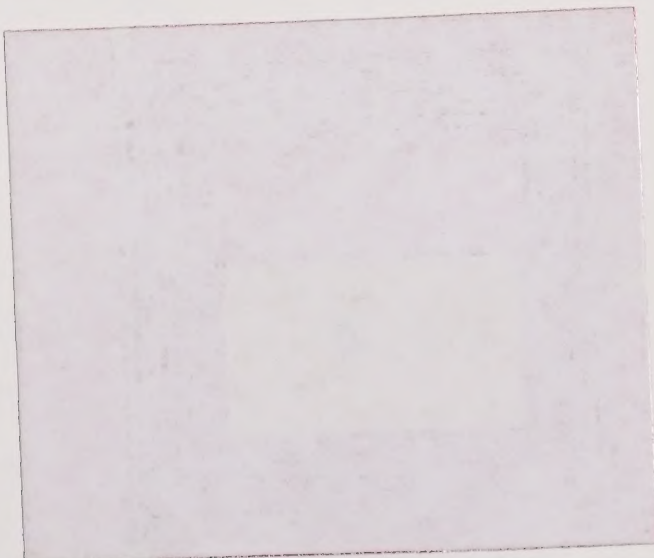
Integral accessibility in landmarks:

$$N. I. A. = (1 / \pi r_0^2) \int_{x=-\infty}^{+\infty} \int_{y=-\infty}^{+\infty} \int_{z=0}^{\exp - [(\frac{a+c}{r_0})^2 + (\frac{b}{Lr_0})^2]} dx dy dz$$

in which (πr_0^2) represents the volume under the accessibility surface of the range "r₀" of the pedestrian.

It has proved important for clarity of thought, to have two versions of the same size unit, seamarks where sea transport is involved, landmarks where it is not. Seamarks and landmarks are not freely interchangeable, and the situation bears close resemblance to mathematical functions of a complex variable, where there are several different values for the same point. An analysis of the nature of this duality is beyond the scope of this appendix. Let us just mention here that the integral accessibility in sea-marks is in many important cases the larger one by far.

Once we have the tools of relative and integral accessibilities, it is a simple matter to use them as weighting factors in calculating the net effective influence upon a particular location, of various regional statistics, such as the capital investment within its reach, the number of jobs, the populations figures, the industrial output, the agricultural production or any other factor we happen to be concerned with at the given moment.

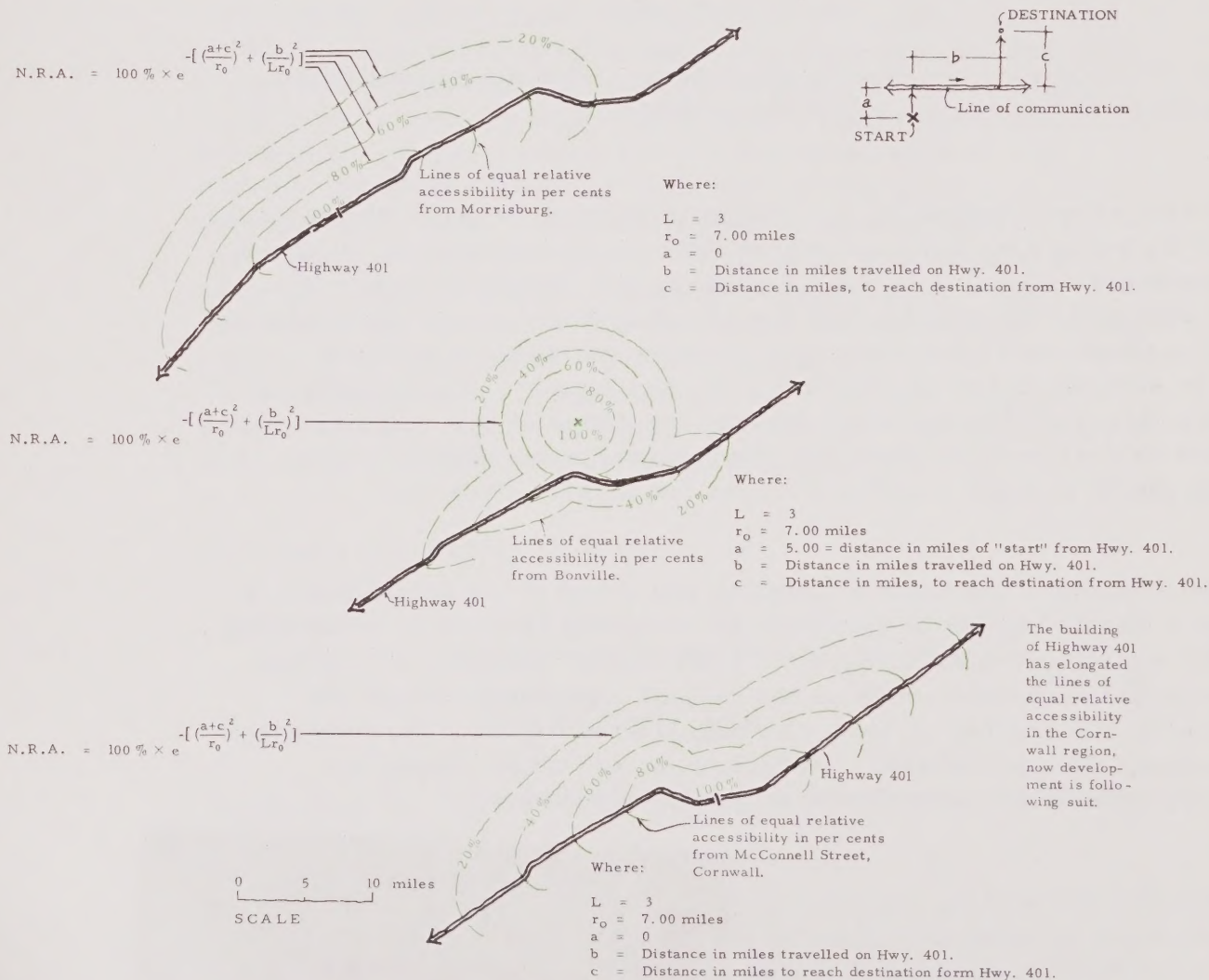


THE CONCEPT OF RELATIVE ACCESSIBILITY

Three examples in Eastern Ontario extracted from the Official Plan 1968 of the City of Cornwall

WE SAY THAT THE POINT WE ARE IN AT A GIVEN MOMENT IS TO US 100% ACCESSIBLE. FOR EXAMPLE, IF WE WILL SPEAK OF THE RELATIVE ACCESSIBILITIES, RELATIVE TO MORRISBURG, ONTARIO (AS IN FIRST DIAGRAM BELOW), WE WILL SAY THAT THE RELATIVE ACCESSIBILITY OF ANY OTHER PLACE IN THE WORLD (RELATIVE TO MORRISBURG) IS A GREATER OR SMALLER PART OF 100% ACCORDING TO WHETHER IT IS EASIER OR MORE DIFFICULT TO GET THERE FROM MORRISBURG. THE REASONS WHY SOME PLACES MIGHT BE LESS ACCESSIBLE FROM MORRISBURG ARE, OF COURSE, NUMEROUS. FOR EXAMPLE: TIME NECESSARY TO GET THERE, CASH INVOLVED, LEGAL RESTRICTIONS TO TRAVEL OR IMPORT, CAPACITY OF TRANSPORT SYSTEM, ETC.

TO THE MATHEMATICAL READER WE CAN SAY THAT THE RELATIVE ACCESSIBILITY IS IN PRINCIPLE A FREQUENCY FUNCTION, WITH THE MODE IN THE POINT OF DEPARTURE OR ARRIVAL.



HOW DO WE GET, IN PER CENTS, THE RELATIVE ACCESSIBILITY OF ANY TWO POINTS, SAY FROM 'A' TO 'B'? TO ASK WHAT IS ACCESSIBLE FROM 'A' HAS NO MEANING. ALL WE CAN ANSWER IS, THAT TODAY, IN THE 20TH CENTURY, ANY POINT ON OUR GLOBE (AND MANY A PLACE BEYOND) IS ACCESSIBLE FROM 'A'. IT IS AN ENTIRELY DIFFERENT MATTER IF WE SPECIFY A RANGE, SAY BY ASKING WHAT IS ACCESSIBLE FROM 'A' WITHIN AN HOUR. THUS WE HAVE TO DEAL WITH TWO FURTHER SUBJECTS HERE AND NOW - WITH DISTANCES SHRINKING ALONG COMMUNICATIONS, AND WITH THE CONCEPT OF A RANGE.

THE CONCEPT OF SHRINKING DISTANCES IS NOT A NEW CONCEPT. IT HAS BEEN KNOWN FOR SOME TIME THAT SINCE THE INTRODUCTION OF FAST MECHANIZED TRANSPORT, DISTANCES HAVE SHRUNK ALONG COMMUNICATIONS.

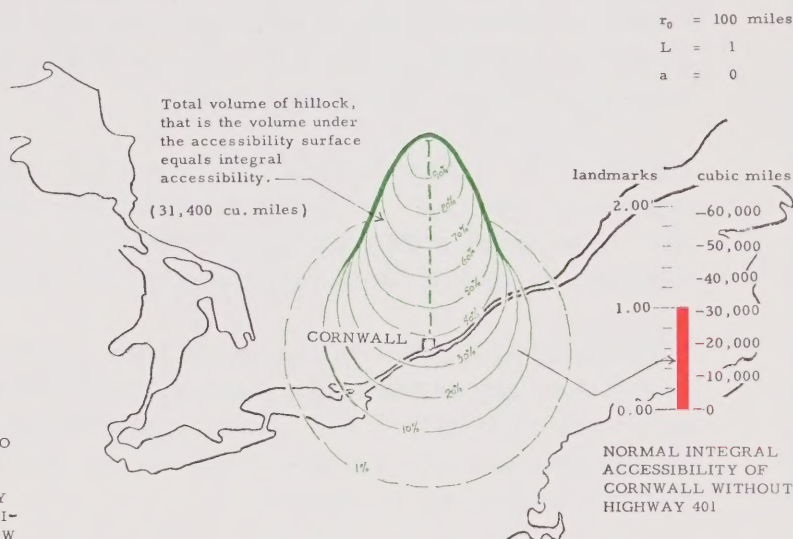
THE CONCEPT OF A RANGE IS ALSO NOT VERY NEW. IT HAS BEEN KNOWN FOR A LONG TIME, THAT PHENOMENA OFTEN COVER A CERTAIN RANGE. THE DISTANCE WE CAN TRAVEL FOR RECREATION ON A SATURDAY AFTERNOON, THE RANGES OF VARIOUS AIRCRAFT TYPES, THE DISTANCE MILK IS DELIVERED, IN HISTORY THE AREA COVERED BY THE FIREARMS OF A BATTLESHIP, OR THE DISTANCES DETERMINED BY THE TIME AND FARES PEOPLE ARE ABLE AND WILLING TO AFFORD FOR DAILY TRAVEL TO WORK TODAY, ARE SOME EXAMPLES. THE CONCEPT OF A RANGE IS A CORNERSTONE IN ANY INVESTIGATION ON ACCESSIBILITY.

THE CONCEPT OF INTEGRAL ACCESSIBILITY

WE WILL CALCULATE THE VOLUME UNDER THE ACCESSIBILITY SURFACE (SEE FIGURE). THE LARGER THIS VOLUME, THE BETTER THE INTERCONNECTION OF THE POINT WITH THE SURROUNDING WORLD. THE VOLUME UNDER THE ACCESSIBILITY SURFACE THEREFORE MIGHT BE REGARDED AS THE LEVEL OF INTER-CONNECTION OF THAT POINT, A MEASURE OF INTER-CONNECTION WITH THE SURROUNDING REGION AND WITH THE WORLD AT LARGE. THIS IS THE INTEGRAL ACCESSIBILITY OF THE POINT IN QUESTION.

An example chosen from the City of Cornwall, Ontario.

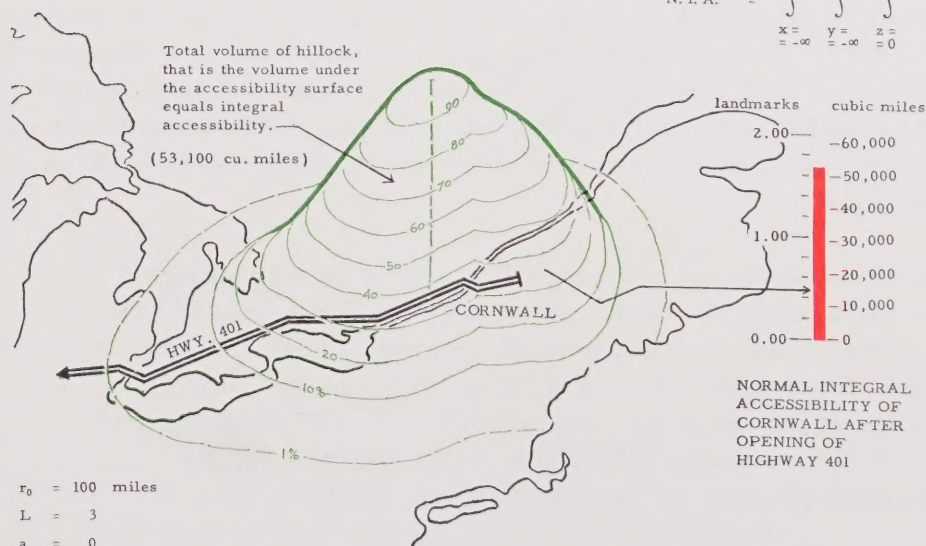
IN FACT WE WILL FIND THAT WE HAVE TO DISTINGUISH TWO TYPES OF CONCEPT, TWO DIFFERENT KINDS OF ACCESSIBILITY, THE RELATIVE ACCESSIBILITY (OF TWO POINTS) AND THE INTEGRAL ACCESSIBILITY (OF ONE POINT). THE RELATIVE ACCESSIBILITY OF TWO POINTS AS A MEASURE OF HOW INTER-CONNECTED THE TWO POINTS ARE WITH EACH OTHER OR HOW ACCESSIBLE THE TWO POINTS ARE FROM EACH OTHER, THE INTEGRAL ACCESSIBILITY OF A POINT AS A MEASURE OF HOW INTER-CONNECTED THAT POINT IS WITH THE REST OF THE WORLD,



WE CAN EXPRESS IN CUBIC MILES THE VOLUME UNDER THE SURFACE OF ALL RELATIVE ACCESSIBILITIES (RELATIVE TO POINT "k") THIS WILL GIVE THE INTEGRAL ACCESSIBILITY OF THAT POINT IN CUBIC MILES.

INTEGRAL ACCESSIBILITY IN CUBIC MILES:

$$N. I. A. = \int_{x=-\infty}^{+\infty} \int_{y=-\infty}^{+\infty} \int_{z=0}^{+\infty} \exp - \left[\left(\frac{a+c}{r_0} \right)^2 + \left(\frac{b}{Lr_0} \right)^2 \right] dx dy dz$$



TO THE MATHEMATICAL READER WE CAN SAY, THAT THE INTEGRAL ACCESSIBILITY OF A POINT IS ESSENTIALLY A SCALAR POINT FUNCTION, DEFINED BY THE INTEGRAL OF ITS RELATIVE ACCESSIBILITIES.

METROPOLITAN TRANSPORT PATTERNS

Metropolitan transport patterns can be divided into five types, as illustrated in Figure A.3. The communications of the first two patterns terminate at the centre. This causes serious regional diseases. The last three patterns continue the relative accessibilities straight through, and terminate the communications in the outer parts of the metropolitan region. Our subdivision is due to Blum.

Pattern 'A' shows a ring pattern which has the worst consequences of the lot. In several cases the radial lines of pattern 'A' have been extended and joined into a Central Railway Station, so going over into pattern 'B' and 'C'.

The integral accessibilities are then very different if we terminate all communications at the Centre as in pattern 'B' and very different if we continue the lines through the centre and terminate our communications on the fringes of the metropolitan region as in pattern 'C'.

Pattern 'D' opens up the single central focus of the metropolitan region, subcentralizing the integral accessibility into a number of centres, and is therefore superior to pattern 'C', but it is still not the best, because the interchange between areas on lines I and II, and areas on lines III and IV, is difficult.

The three requirements: no overcentralization, clear diameter lines and easy transit between all parts of the metropolitan region are best fulfilled by Blum's pattern 'E'. This pattern is therefore recommended as a start (not as a recipe) for the development of a pattern for a metropolitan transport system. The framework of pattern 'E' can be also recommended in developing a network of trams or bus lines.

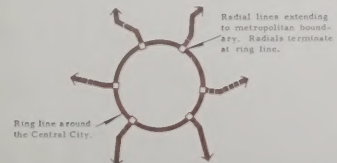
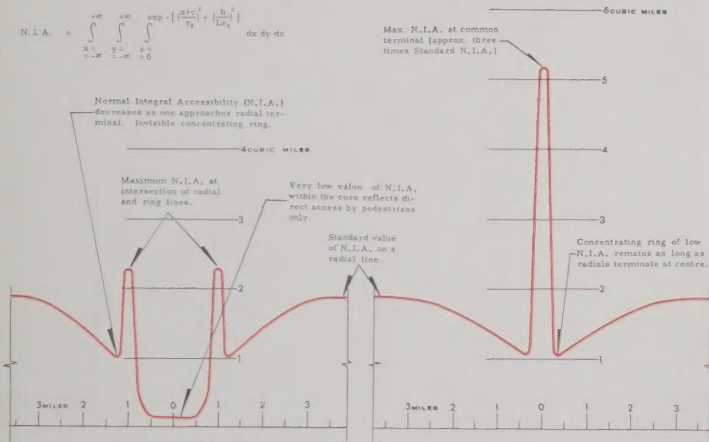
The shape of the integral accessibility curve of any pattern depends of course upon the range we are thinking in. If the distances between the subcentres of pattern 'D' or 'E' are insignificant if compared to the size of our Range, then patterns 'D' and 'E' go over into pattern 'C'. If we think in ranges in which the diameter of the ring, pattern 'A' is negligible, then pattern 'A' goes over into pattern 'B'.

Source: "Stadtebau", O. Blum. p.212 e.f., Berlin, Springer, 1937

CONSTANTS
 PEDESTRIAN RANGE: $r_0 = 6.2$ MILES
 SHRINKAGE FACTOR: $L = 15$
 TRANSIT RANGE: $P_0 = L \cdot r_0 = 3.0$ MILES

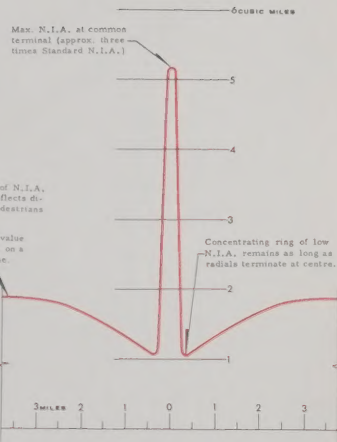
TRAVEL PARAMETERS
 a = DISTANCE FROM ORIGIN TO REACH TRANSPORT LINE
 b = DISTANCE TRAVELLED ALONG TRANSPORT LINE
 c = DISTANCE FROM TRANSPORT LINE TO REACH DESTINATION

$$N.I.A. = \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} \int_0^{\exp\left(-\left(\frac{a^2}{r_0^2}\right) + \left(\frac{b^2}{L^2}\right)\right)} dx dy dz$$



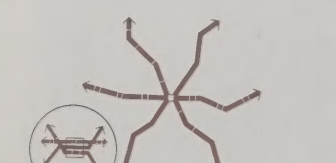
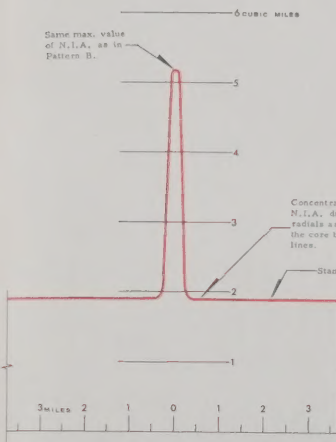
PATTERN A

THE ACCESSIBILITIES WHICH RESULT FROM THE TERMINATION OF RADIAL COMMUNICATIONS OUTSIDE THE CITY CENTRE ARE VERY UNFORTUNATE, EXCEPT FOR THE SHARP PEAKS WHERE THE RADIALS CROSS THE RING LINE. OUTSIDE THE CENTRE, INTEGRAL ACCESSIBILITY ASSUMES A NEGATIVE GRADIENT AS WE APPROACH THE CORE. THE LOW ACCESSIBILITY OF THE CORE, IF MAINTAINED FOR SEVERAL GENERATIONS WOULD NATURALLY RESULT IN A DEAD HEART OF THE METROPOLIS.



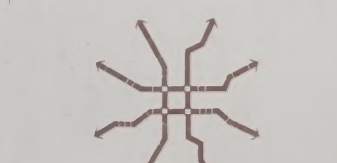
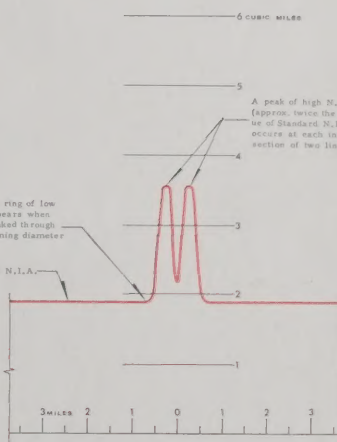
PATTERN B

THIS TRANSPORTATION PATTERN CREATES AN ENORMOUS PEAK OF INTEGRAL ACCESSIBILITY AT THE CENTRE, SURROUNDED BY RING OF LOW ACCESSIBILITY. THIS INVISIBLE RING HAS A STRONG CONCENTRATING EFFECT, GIVING RISE TO SOME OF THE MOST INACCESSIBLE PLACES OF THE METROPOLITAN REGION IN THE NEAREST VICINITY OF THE CORE, IMMEDIATELY SURROUNDING THE CENTRE.



PATTERN C

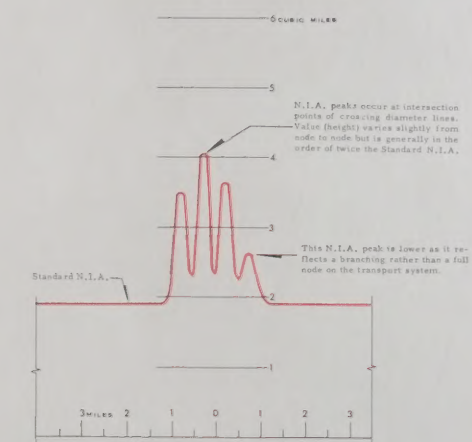
BY CONTINUING THE RADIALS THROUGH THE CENTRE CLEAR TO THE OTHER SIDE OF THE METROPOLITAN AREA, RATHER THAN TERMINATING THEM AT THE CENTRE, THE CONCENTRATING RING OF LOW ACCESSIBILITY ABOUT THE CORE IS ELIMINATED. HOWEVER, THE MAINTENANCE OF A SINGLE COMMON POINT OF INTERSECTION WITHIN THE CORE CARRIES WITH IT THE UNDESIRABLE ELEMENT OF OVERCENTRALIZATION.



PATTERN D

THIS WELL KNOWN PATTERN OPENS UP THE SINGLE CENTRAL FOCUS, SUBCENTRALIZING ITS INTEGRAL ACCESSIBILITY INTO A NUMBER OF CENTRES, AND IS THEREFORE SUPERIOR TO PATTERN "C". HOWEVER, IT IS STILL NOT QUITE CORRECT, BECAUSE THE INTERCHANGE BETWEEN AREAS ON LINES I AND II, OR AREAS ON LINES III AND IV, IS CUMBERSOME, REQUIRING TWO LINE TRANSFER OPERATIONS. THUS, THE PROBLEM IS ONE OF RELATIVE ACCESSIBILITY.

METROPOLITAN TRANSPORT PATTERNS



PATTERN E

THE PLAN OF PATTERN "E" IS OVERCOME BY AN ARRANGEMENT WHEREIN EACH LINE INTERSECTS EVERY OTHER LINE AT, AT LEAST, ONE POINT. SUBCENTRALIZATION OF INTEGRAL ACCESSIBILITY IS ACHIEVED TO AN EQUAL OR BETTER DEGREE, DUE TO THE INCREASE IN THE NUMBER OF INTERSECTION POINTS. NO MORE THAN ONE INTERCHANGE IS REQUIRED TO TRAVEL BETWEEN ANY TWO POINTS ON THE SYSTEM.

RAPID TRANSIT IN OTHER CANADIAN CITIES

CALGARY

Excerpt from: "TRANSIT FOR CALGARY'S FUTURE", 1967.
Simpson & Curtin, Transportation Engineers.

INTRODUCTION

The Calgary Transit System is serving a population of 335,800 people. Recent population growth has been at the rate of 1,000 new people per month and the City Planning Department estimates that Calgary will pass the half-million mark by 1976. Within 20 years, this will increase to three-quarters of a million people with a 1986 population of 775,730. A program must be developed to provide homes, jobs and mobility for 439,930 more people - more than double all of Calgary's present municipal facilities.

1986 TRANSIT ALTERNATIVES

A rapid transit system of almost 20 miles of grade-separated routes was devised in an attempt to incorporate a standard of rapid service which is the highest prospective transit development for the area. Four major corridors were considered for grade-separated rapid routes with downtown as the focal point. A northwest line serving the rapidly growing University of Calgary and residential sectors was developed along with a route to the south providing service to the stampede grounds (which includes potential for a major park-ride facility, 11 months of the year), Chinook Center and the rapidly expanding residential section south of 82nd Avenue. The Killarney - 26th Avenue section south and west of downtown is a third sector for consideration of grade-separated transit. The fourth corridor involves the major traffic flow to downtown generated along Center Street in the north sector. Figure A.4 defines the major elements of the network of grade-separated rapid routes designed for this test system. Passenger access is provided through 39 stations averaging one-half mile

spacing (five CBD stops). In addition to rapid service in the four major corridors, a network of 405 round-trip route miles of express, crosstown, feeder and arterial bus routes is provided.

Portions of the rapid transit network were tested as a third alternative to investigate the economics of stage development of the full rapid transit system. For this purpose, the north route along Center Street and the west route to Killarney were eliminated. Express bus service was designed for these areas with rapid transit service to downtown continuing along the northwest leg and the south leg to Chinook Center and 98th Avenue. Each of these alternatives was analyzed to determine the projected number of riders attracted from automobiles along with revenue and capital and operating costs.

1986 TRANSIT USE

With the proposed rapid transit system in operation, the total number of transit trips increases by more than 120,000 riders per day to a 1986 total of 192,990. Notwithstanding this significant increase, the relative use of transit decreases from 13.2% of total travel to 12%. This estimate must be considered conservative since the input to the transit estimating procedure requiring location of employment and population in 1986 was based on an automobile oriented land use plan with no adjustments in the corridors to be served by rapid transit. Preliminary estimates by the Planning Department indicate that almost 100,000 persons of the anticipated 775,000 future population would be relocated into higher density development in the vicinity of rapid transit lines.

OPERATING RESULTS - 1986 ALTERNATIVES

Estimates of annual operating revenue, operating cost and capital cost were developed for a wide range of systems as summarized below: (See following Table)

Gross operating revenue for 1986 ranges from \$12,185,660 for the express bus system up to \$14,289,530 for the rapid transit system - a four-fold increase over 1966. Capital and operation costs have been prepared from a route-by-route analysis of system-wide transit operations under each alternative.

COMPARISON OF OPERATING RESULTS

ALTERNATIVE TRANSIT SYSTEMS

	Gross Operating Revenue	Capital and Operating Costs	Deficit
1966 Calgary Transit System	\$ 3,562,280	\$ 4,469,270	\$ 906,990
1986 Systems			
'Express Bus'	12,185,660	12,478,830	293,170
Rapid Transit	14,289,530	16,194,250(1)	1,904,720
'Interim' Rapid Transit	13,224,580	14,434,290	1,209,710
1978 Systems			
'Express Bus'	10,235,940	10,395,190	159,250
'Interim' Rapid Transit	11,108,630	12,939,650	1,831,020

(1) Rapid transit capital costs are shown for system with downtown section elevated. For subway through C.B.D. add \$1,029,000 to all rapid transit deficits.

Capital and operating costs for the rapid transit system aggregate \$16,194,250. This total is comprised of \$8,439,360, in rapid transit and bus operating costs, \$1,134,490 for the purchase of 130 rapid transit vehicles and 11 new buses, and \$6,620,000 to amortize the cost of rapid transit line construction. When measured against operating revenue, this total cost results in an annual deficit of \$1,904,720.

Construction costs for the 19.6-mile rapid transit system are based on the prototype Westinghouse Transit Expressway system, since costs for the alternatives would not vary appreciably. The four radial legs with an elevated section through downtown develop a total cost of \$99,614,000 - an average of \$5.08 million per mile. If the downtown portion of the line were in subway, the cost would be increased by approximately \$15.5 million, bringing the cost of the entire system to \$115,098,000. The annual difference between these two costs is \$1,029,000.

The interim rapid transit system develops a deficit of \$1,831,020 in 1978. It becomes evident that the nub of the decision as to timing of rapid transit development is basically a question of whether or not the downtown plan approved by Council last year is ever to be achieved. Estimates of revenue and cost figures for the express bus system are basically academic because the projections for downtown employment and retail activity which form the basis of the analysis would never be achieved with surface bus operation. If downtown accessibility is to be as restricted as would be indicated by the surface bus alternatives, employers and merchants would relocate to outlying shopping centers and office parks. This escape from downtown congestion has been experienced in a large number of American cities served by surface bus systems. If the downtown plan, goals and objectives are ever to be realized, downtown accessibility must be considerably improved in the mid- 1970's.

THE NEED FOR RAPID TRANSIT

There has never been an "unsuccessful" rapid transit system. The iterative relationship between rapid transit and land development is underscored in the San Francisco Bay Area - even now, before the Bay Area Rapid Transit District is operating, some \$300 million in new construction is either programmed or already in the building stage along the BARTD right-of-way.

The allocation of 1986 population and employment to geographical subdivisions of Calgary relied principally upon automobile accessibility to develop a land use pattern. No account was taken of the amply demonstrated 'feedback' effect which transit improvements will have on the land development pattern, and projections prepared by the Planning Department must be carefully reevaluated in light of the elements of the overall transportation plan. Projections of rapid transit passengers and revenues developed in this study have relied on the auto oriented 1986 population and employment patterns and must, therefore, be considered conservative estimates of the full potential for rapid transit in Calgary.

Cursory analysis of the impact of the rapid transit system on land development by the Planning Department indicates that 96,500 persons of the anticipated 775,730 population will be relocated into higher density development in the vicinity of the rapid transit lines.

The land development implications of high-speed transit - which have been the universal experience of all cities with rapid transit - far outweigh the revenue/cost ratio developed by the transit system itself. The bigger question relates to the kind of city Calgary can afford to be by 1986 and beyond. A reliance on surface transit will require considerable expenditure for highway development which will generate a 'spread city' with low density residential development and multiple employment and shopping centres. Development of rapid transit has consistently generated more compact and orderly development with a strong downtown and clustered residential development. The use of rapid transit as a land development tool has been amply demonstrated by the T-Bana in Stockholm where the rapid transit line to suburban communities is developed before the community. This creates an orderly cluster development pattern with the rapid transit station as the focal point of each subdivision.

If a strong downtown is to prevail with orderly residential development, then high-speed transit is a necessity. This is certainly the most reasonable of the alternatives. The community benefits to be derived from a vigorous program of high-speed transit far outweigh the cost of providing this service

EDMONTON

Excerpt from: "GENERAL PLAN, CITY OF EDMONTON", 1967

A rapid transit system is proposed for Edmonton as part of a balanced transportation network. In 1963 Canadian Bechtel Limited prepared a rail rapid transit plan for the City as a mode for mass transportation to handle peak period movements to and from the Central Area.

Alignment of branch lines were determined by such factors as rights-of-way location, travel characteristics and growth and population forecasts. Since this is a conceptual plan, further feasibility and economic studies will be required to co-ordinate routes and rights-of-way with accepted M. E. T. S. roadway proposals.

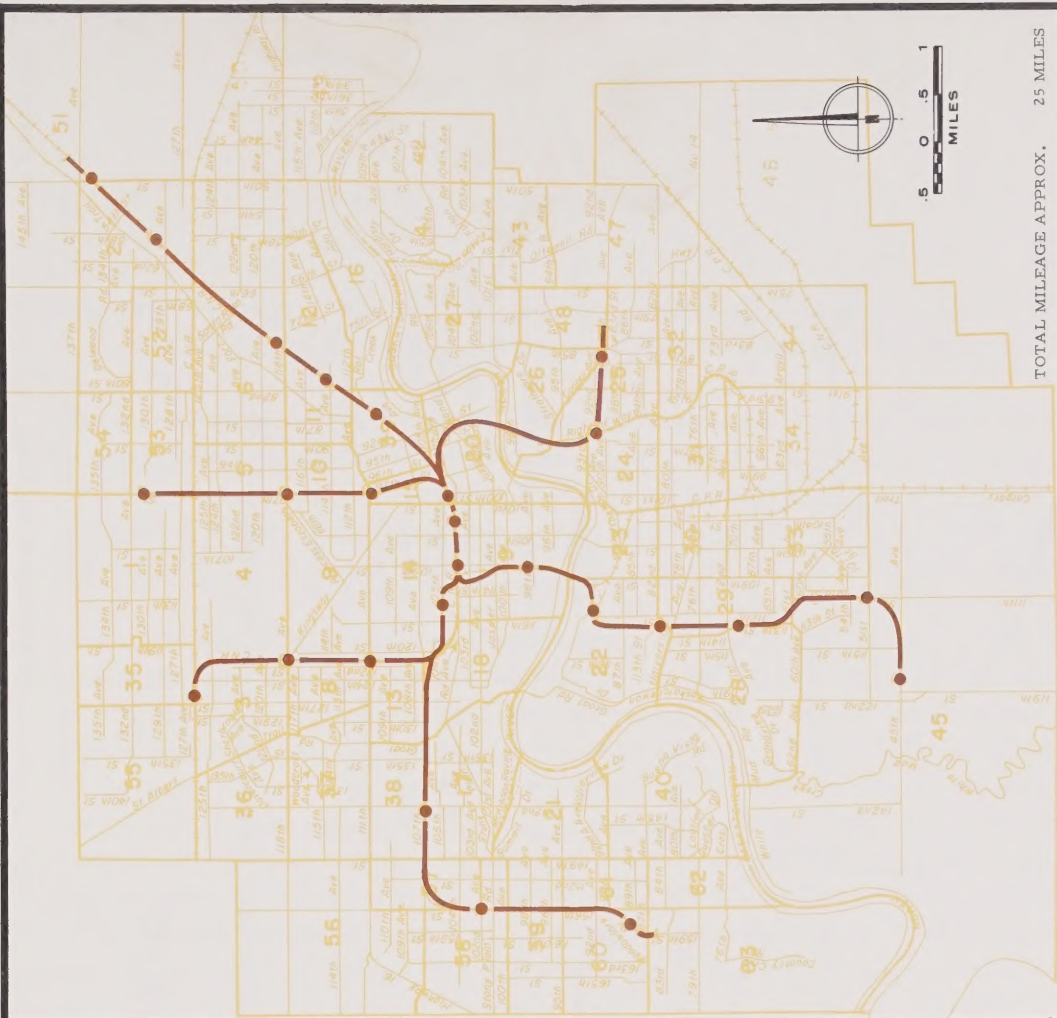
Principal design features consist of:

- a modern and efficient system to attract a maximum number of commuters.
- a double track electrified railway protected by interlocking automatic signals.
- an exclusive grade separated right-of-way with depressed, underground or elevated grades.
- six branch lines to converge and pass through the Central Area with underground tracks and stations in the Central Area.
- twenty-five miles of rail line with twenty-six stations placed about a mile apart with provision for branch line extensions.
- a five-minute headway between trains during peak periods.
- a 50 m. p. h. running speed, requiring 10 minutes to reach downtown from a terminal station.
- 138 transit cars able to move 31,000 people per hour to the Central Area. Capacity may be doubled by adding more cars to the system or adjusting the running schedules.



CALGARY

TOTAL MILEAGE APPROX. 20 MILES



EDMONTON

TOTAL MILEAGE APPROX. 25 MILES

PROPOSED RAPID TRANSIT ROUTINGS FOR THE CITIES OF **CALGARY AND EDMONTON**

FIGURE A.4



FIG. A. 5

RAPID TRANSIT AND COMMUTER RAIL NETWORKS : EXISTING AND PROPOSED

TORONTO

SOURCE: "A Concept for Integrated Rapid Transit and Commuter Rail Systems in Metropolitan Toronto," Toronto Transit Commission.

CITY OF HAMILTON PLANNING DEPARTMENT
March 1969, First Edition
DRAFT OFFICIAL PLAN 1970 OF THE CITY OF HAMILTON

TORONTO

Excerpt from; "GOING PLACES", Second Quarter, 1968.
Published by the General Electric Company.

"For any major urban area, rapid transit as the base of a balanced transportation system cannot be equaled in its ability to create and maintain property values. If an urban rapid transit system never earned a dime, it would pay for itself many times over through its beneficial impact on real estate values and increased assessments."

With its incorporation on January 1, 1954, the Toronto area became the first community in the western hemisphere to give political recognition to the metropolitan area as the newest form of urban settlement created by modern industrial society. The municipality of metropolitan Toronto was created as a federation of 13 separate municipalities, each retaining local autonomies and responsibilities, but passing over to the municipal government the responsibilities for major regional services. Among these was public transportation. With the incorporation, the Toronto Transportation Commission passed from existence; in its place is the Toronto Transit Commission.

SUBWAY IGNITES BUILDING BOOM

The major achievement in public transit in metropolitan Toronto has been the successful creation of a subway system. Even in 1942, it was realized in 25 years that the growth and expansion of Toronto soon would result in a situation which would be beyond the capacity of a surface street car route on Yonge Street, the most heavily traveled route. Separation of street car and automobile traffic was the obvious solution, and the commission began to study a rapid transit system for the city.

On March 30, 1954, Yonge Street subway was opened (14 years). The total length was 4.5 miles, of which approximately three miles was underground. The total cost of this subway including right of way, rails, electrical distribution system, signal system, and rolling stock was \$ 67,000,000.

This small investment in a subway system ignited a \$ 10 billion development explosion along the route from Front and York Streets to the northern terminal, Eglinton Avenue. The appraised value of all the land and facilities in metropolitan Toronto is now \$ 50 billion. An appreciation of \$ 15 billion in physical value has been

added in the last ten years; and of this, two-thirds is attributable to the existence of the Yonge Street subway. Properties along the subway route doubled and tripled, sometimes increasing as much as ten times their original value. Land sales at \$ 125 to \$ 150 per square foot near the downtown stations became common. Between 1952 and 1962, the increase in tax assessment in districts contiguous to the Yonge Street subway line was 45% in the downtown area and 107% from College Street to Eglinton Avenue. The assessment increase for the rest of the city during the same period averaged 25%. On this basis, the Yonge Street subway has earned enough new tax dollars to pay its annual amortization costs.

Another \$ 2 billion in building construction is in the planning stages or underway in downtown Toronto. There is no doubt that the subway to downtown and the new \$35 million City Hall are speeding the redevelopment. Each year between two and three million square feet of new office space and 5000 apartments, of which 3000 are within walking distance of the subway, are being added to Toronto's skyline.

Hundreds of large residential lots, 175 feet wide and 200 feet in depth, were rezoned to accommodate high-density apartment buildings. The apartment land boom brought as much as \$ 4000 per suite to speculators. Rates offered to homeowners were \$ 1000 to \$ 2000 per front foot. Many families who bought modest houses at \$ 15,000 to \$ 25,000 sold them to developers for \$ 50,000 to \$ 75,000. Downtown land is selling at up to \$ 200 per square foot, or at the rate of \$ 8.7 million per acre.

Therefore, it can be concluded that a subway has a tremendous impact on land use, and consequently on land values.

TORONTO EXTENDS RAPID TRANSIT SYSTEM

Less than five years after the opening of the Yonge Street subway, plans were underway for the Bloor-Danforth-University subway, an eight-mile east-west line with a two-mile extension beneath University Avenue to connect with the Yonge Street subway. Construction began in 1959 and the University extension was opened early in 1963. The eight-mile crosstown section of the \$ 200 million project now is completed and is assuming a major role in metropolitan Toronto's balanced transportation system.

But there is no lull in subway construction activity. Two more

extensions, which recently opened, will take the subway into suburban districts. The cost of these extensions will total \$ 77 million. With their recent completion, the Bloor-Danforth line is now over 14 miles long, and metropolitan Toronto will be crisscrossed by 21 miles of modern subway lines.

The city section of the Bloor-Danforth line currently carries 25,000 passengers hourly. It is expected to increase to 35,000 and then to 37,000 passengers hourly with the opening of the extensions. The subway line is designed to carry 40,000 person hourly -- triple the number of passengers formerly transported on the Bloor-Danforth street car and bus service.

In the 12 years it has taken to build the 14.26 mile Bloor-Danforth subway line across metropolitan Toronto, the number of vehicles on the streets has more than doubled to an estimated 700,000. The Toronto Transit Commission hopes that the economy, convenience, and speed of the subway will lure up to 15% of the Etobicoke and Scarborough motorists away from rush-hour jams and the frantic search for downtown parking space. (It is interesting to note that several months after the Yonge Street subway opened in 1954, the Commission found that 13% more transit riders were using the subway than previously had used the street car and bus system).

Detailed planning now is in progress to add a 4.5 mile, \$ 87 million northern extension to the Yonge Street subway, and acquire the right of way for a possible future 1.25-mile extension to Finch Avenue, at an estimated cost of \$ 2 million to \$ 2.5 million. A six-mile rapid transit line also is proposed in connection with the Spadina Expressway.

CITY RECOMMENDS ZONING CHANGES

Money was rolling along the tracks even ahead of the trains. New business and higher assessments are following the transit lines. Properties adjacent to the east-west subway which were valued at \$ 250 million before the project was announced, already have doubled in value to \$ 500 million. The subway's influence on rezoning along the line is expected to generate \$ 2 billion in office and apartment construction in the next ten years.

The City of Toronto Planning Board recognized the impact on the air rights and land use adjacent to the Bloor subway with a comprehensive report recommending significant zoning changes. These

changes, if carried through in full, will double and triple the market prices for land almost overnight. Larger sites than actually needed for rights of way were assembled to attract larger development proposals. In many of the prime locations, the subway structure was reinforced to permit additional construction above it. In many instances the best potential use of the lands is realized by their development jointly with adjacent, privately-owned property. The manner of the disposal of these lands, as well as the way in which they are used, is important to the city.

PLAN FOR REGIONAL GROWTH

A logical long-term plan for regional growth would be to establish a system of efficient commuter train lines and to channel development of satellite cities to key points of this system.

Within a 30-mile radius of Toronto, development of satellite cities on low-priced marginal tracts will open thousands of acres of land. With their development, it will become common for commuters to travel 50 to 75 miles to work each day. Provision for adequate transportation services to connect them with metropolitan Toronto will be an important aspect of their development.

TRANSPORTATION AND URBAN DEVELOPMENT

In Toronto it has been found (and it has been borne out by regulations suggested in the San Francisco Downtown Zoning Study) that proximity to a subway station has profound effects on business and land uses, especially those arising from housing, manufacturing, and commerce. The amount and intensity of new development and the volume of retail sales at a given point on the rapid transit line are directly proportionate to the passenger traffic to and from the nearest subway station.

Transportation and development must be planned jointly. Ease of access encourages development, and development generates movement. A plan for one makes sense only if integrated with an appropriate plan for the other. The maximum integration of all forms of transportation (transit, train, car, truck, etc.) must be sought to achieve the best use of each and the best overall results. A system must be established that will permit continuing growth without congestion. Downtown, the heart of the region, must be accessible from all parts of the entire region and should offer its residents attractive surroundings in which to live and work.

WINNIPEG

Excerpt from: "WINNIPEG AREA TRANSPORTATION STUDY",
1968. Prepared by the Streets and Transit Division.

In order to be attractive to passengers by providing a high level of service, a transit system of the future could not rely entirely upon surface bus lines sharing the surface street system with other traffic. Accordingly an extensive system of rapid transit lines operating at high speeds on exclusive grade separated rights-of-way was developed for testing (See Fig. A. 6).

The system would comprise 48.5 miles of rapid transit line and 595 miles of feeder bus routes requiring the operation of 76 trains and 705 buses. The rapid transit system would be served by 57 stations spaced at 0.44 to 1.89 mile intervals in the intermediate and suburban areas and, on an average, at 0.47 mile intervals in the downtown area.

This system would consist of two lines, a single north-south line and an east-west line which would branch at each end to serve different parts of the metropolitan area.

In developing the concept of this extensive rapid transit system, an attempt was initially made to combine the rapid transit routes with the proposed freeway routes. However as the system was developed, it became obvious that the locations of the freeway alignments did not lend themselves to favourable rapid transit line location, in that existing or anticipated high density residential developments and major transit trip attractors were remote from the freeways. As a result many of the stations could not easily be reached on foot and would require an additional, sometimes lengthy, trip by feeder bus, thus adding trip time and reducing the overall attractiveness of the rapid transit system.

However, an effort was made to utilize existing railroad line rights-of-way (which might be abandoned in the future or operated jointly) and existing utility transmission lines (where their location permitted the servicing of abutting areas). As a result, approximately 45 percent of the rapid transit system utilizes such existing rights-of-way or presently undeveloped land.

Another 47 percent utilizes existing street rights-of-way. It

was assumed that, in existing built-up areas, the rapid transit lines would lie beneath existing street rights-of-way, thus minimizing land acquisition costs and disruption to the developed area.

The system would employ equipment which could operate at speeds up to 50 miles per hour where station spacings were sufficiently great to permit attainment of this speed. The north-south route was assumed to operate at 2.0 minute headways between trains in the peak hour and the east-west route at 1.5 minute headways along Portage Avenue between Polo Park and Main Street. Where this line splits at each end, successively longer headway times would be experienced.

[For reasons of economy, and in an attempt to more evenly distribute the tax dollar toward major street improvements and freeway construction, as well as rapid transit, the above text system was cut back to a minimal 5.4 mile run through the Central Area. This segment, shown in black on Figure A.6, was presented as the recommended rapid transit system for the design date of the study, 1991. Of this "system", the study goes on to say:]

This system comprises a high capacity 5.4 mile grade separated rapid transit line extending from Polo Park on Portage Avenue West to the intersection of Hespeler Avenue and Henderson Highway. This rapid transit corridor is complemented by a network of feeder surface bus routes oriented towards the eleven stations along its length, four of which are located in the downtown area. Available or planned parking areas in the vicinity of the rapid transit terminal stations would provide "park and ride" facilities for transit riders who wish to use their cars for part of the trip from home to the terminal station. Complementing the rapid transit and feeder bus system are a number of freeway express bus routes which utilize four of the five proposed internal radial freeways and provide high speed limited stop service from the suburban areas to Downtown.

The rapid transit line recommended for this area by 1991 lends itself to further extension or addition along corridors of urban growth and could, in the second 25 year period, take the shape of the [overall] system [indicated in brown] .

LEGEND

- — ● 1991 PROPOSAL
5.4 MILES
- — ● CONCEIVED ULTIMATE NETWORK
48.5 MILES TOTAL



FIGURE A.6

PROPOSED RAPID TRANSIT ROUTING

FOR THE CITY OF

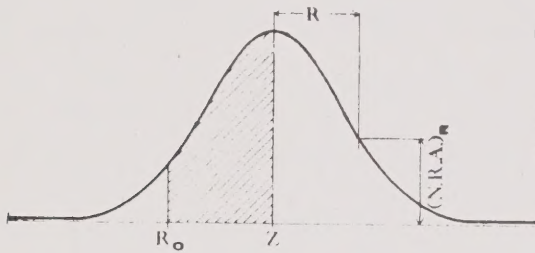
WINNIPEG

ACCESSIBILITY

TABLES

RELATIVE

The phenomenon of Normal Relative Accessibility (N.R.A.) is closely analogous to the Gaussian probability function. Consequently, with reference to a point Z, we assume:



$$(N. R. A.)_R = 100 \% \times \exp -[(R/R_0)^2]$$

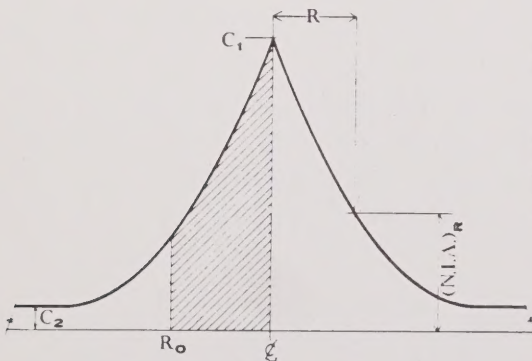
R = Distance from point Z

R_0 = the range, or standard radius

Values of N.R.A. are tabulated against the ratio (R/R_0) in the following "Table A. 1".

INTEGRAL

Not infrequently, a radial plot of values of Normal Integral Accessibility (N.I.A.) about a node or line of communication exhibits a proportionality to the complement of the Error Function; that is,



$$(N. I. A.)_R = C_1 \times [1 - \operatorname{erf} (R/R_0)] + C_2$$

C_1 = max. value of N.I.A. at centre

R_0 = minor range acting as standard radius

C_2 = min. value of N.I.A. based on minor range accessibilities alone

The following "Table A. 2" tabulates this relationship. The constants C_1 and C_2 are fixed at 1000 and 0, respectively, but actual values may be readily substituted according to above formula.

TABLE A. 1
NORMAL RELATIVE ACCESSIBILITY

(N.R.A.)%	Distance Ratio (R/R ₀)					
00.00	∞	2.91842	2.79715	2.72371	2.63037	2.62826
	.00	.02	.04	.06	.08	.10
00.0	∞	2.49291	2.34978	2.26186	2.19734	2.14597
	0.0	0.2	0.4	0.6	0.8	1.0
00	∞	1.97788	1.79412	1.67732	1.48925	1.51743
10	1.51743	1.45611	1.40218	1.35373	1.30950	1.26864
20	1.26864	1.23050	1.19462	1.16064	1.12826	1.09726
30	1.09726	1.06744	1.03866	1.01077	0.98366	0.95723
40	0.95723	0.93140	0.90608	0.88121	0.85672	0.83255
50	0.83255	0.80866	0.78496	0.76146	0.73806	0.71472
60	0.71472	0.69140	0.66805	0.64460	0.62102	0.59722
70	0.59722	0.57315	0.54873	0.52387	0.49846	0.47238
80	0.47238	0.44548	0.41756	0.38836	0.35754	0.32459
90	0.32459	0.28876	0.24875	0.20204	0.14214	0.00000
	00	02	04	06	08	10
99.0	0.10025	0.08962	0.07758	0.06331	0.04474	0.00000
	0.0	0.2	0.4	0.6	0.8	1.0

EXAMPLE 1

The Sheraton Connaught Hotel is 0.883 miles distant from the C.N.R. Station and 0.294 miles distant from the T.H. & B. Station. Using a range of 0.25 miles as R₀, calculate the normal relative accessibility of each station to a pedestrian hotel guest.

$$\begin{aligned} \text{C.N.R.} &= R/R_0 = 0.883/0.25 = 3.532; \text{ from tables } (N.R.A.)_R < 00.02\% \\ \text{T.H. \& B.} &= R/R_0 = 0.294/0.25 = 1.176; \text{ from tables } (N.R.A.)_R = 25\% \end{aligned}$$

Answer:

Against the specified 1/4-mile pedestrian range the T.H. & B. Station is by foot 25% relatively accessible to the Sheraton Connaught Hotel, whereas the C.N.R. Station is less than two hundredths of a percent accessible.

TABLE A.2
NORMAL INTEGRAL ACCESSIBILITY

(N. I. A.) Distance Ratio ($\sqrt{2}R/R_0$) = 1.414 214 (R/R_0)

00	∞	3.09023	2.87816	2.74778	2.65207	2.57583
10	2.57583	2.51214	2.45726	2.40892	2.36562	2.32635
20	2.32635	2.29037	2.25713	2.22621	2.19729	2.17009
30	2.17009	2.14441	2.12007	2.09693	2.07485	2.05375
40	2.05375	2.03352	2.01409	1.99539	1.97737	1.95996
50	1.95996	1.94313	1.92684	1.91104	1.89570	1.88079
60	1.88079	1.86630	1.85218	1.83842	1.82501	1.81191
70	1.81191	1.79912	1.78661	1.77438	1.76241	1.75069
80	1.75069	1.73920	1.72793	1.71689	1.70604	1.69540
90	1.69540	1.68494	1.67466	1.66456	1.65463	1.64485
100	1.64485	1.63523	1.62576	1.61644	1.60725	1.59819
110	1.59819	1.58927	1.58047	1.57179	1.56322	1.55477
120	1.55477	1.54643	1.53820	1.53007	1.52204	1.51410
130	1.51410	1.50626	1.49851	1.49085	1.48328	1.47579
140	1.47579	1.46838	1.46106	1.45381	1.44663	1.43953
150	1.43953	1.43250	1.42554	1.41865	1.41183	1.40507
160	1.40507	1.39838	1.39174	1.38517	1.37866	1.37220
170	1.37220	1.36581	1.35946	1.35317	1.34694	1.34076
180	1.34076	1.33462	1.32854	1.32251	1.31652	1.31058
190	1.31058	1.30469	1.29884	1.29303	1.28727	1.28155

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TABLE A. 2 (Cont'd)

(N. I. A.)

Distance Ratio ($\sqrt{2}R/R_0$) = 1.414 214 (R/R_0)

200	1.28155	1.27587	1.27024	1.26464	1.25908	1.25357
210	1.25357	1.24808	1.24264	1.23723	1.23186	1.22653
220	1.22653	1.22123	1.21596	1.21072	1.20553	1.20036
230	1.20036	1.19522	1.19012	1.18504	1.18000	1.17499
240	1.17499	1.17000	1.16505	1.16012	1.15522	1.15035
250	1.15035	1.14551	1.14069	1.13590	1.13113	1.12639
260	1.12639	1.12168	1.11699	1.11232	1.10768	1.10306
270	1.10306	1.09847	1.09390	1.08935	1.08482	1.08032
280	1.08032	1.07584	1.07138	1.06694	1.06252	1.05812
290	1.05812	1.05374	1.04939	1.04505	1.04073	1.03643
300	1.03643	1.03215	1.02789	1.02365	1.01943	1.01522
310	1.01522	1.01103	1.00686	1.00271	0.99858	0.99446
320	0.99446	0.99036	0.98627	0.98220	0.97815	0.97411
330	0.97411	0.97009	0.96609	0.96210	0.95812	0.95416
340	0.95416	0.95022	0.94629	0.94238	0.93848	0.93458
350	0.93458	0.93072	0.92686	0.92301	0.91918	0.91537
360	0.91537	0.91156	0.90777	0.90399	0.90023	0.89647
370	0.89647	0.89273	0.88901	0.88529	0.88159	0.87790
380	0.87790	0.87422	0.87055	0.86689	0.86325	0.85962
390	0.85962	0.85600	0.85239	0.84879	0.84520	0.84162
	00	02	04	06	08	10

TABLE A. 2 (Cont'd)

(N. I. A.)

Distance Ratio ($\sqrt{2}R/R_0$) = 1.414 214 (R/R_0).

400	0.84162	0.83805	0.83450	0.83095	0.82742	0.82390
410	0.82390	0.82038	0.81687	0.81338	0.80990	0.80642
420	0.80642	0.80296	0.79950	0.79606	0.79262	0.78919
430	0.78919	0.78577	0.78237	0.77897	0.77557	0.77219
440	0.77219	0.76882	0.76546	0.76210	0.75875	0.75542
450	0.75542	0.75208	0.74876	0.74545	0.74214	0.73885
460	0.73885	0.73556	0.73228	0.72900	0.72574	0.72248
470	0.72248	0.71923	0.71599	0.71275	0.70952	0.70630
480	0.70630	0.70309	0.69988	0.69668	0.69349	0.69031
490	0.69031	0.68713	0.68396	0.68080	0.67764	0.67449
500	0.67449	0.67135	0.66821	0.66508	0.66196	0.65884
510	0.65884	0.65573	0.65262	0.64952	0.64643	0.64335
520	0.64335	0.64027	0.63719	0.63412	0.63106	0.62801
530	0.62801	0.62496	0.62191	0.61887	0.61584	0.61281
540	0.61281	0.60979	0.60678	0.60376	0.60076	0.59776
550	0.59776	0.59477	0.59178	0.58879	0.58581	0.58284
560	0.58284	0.57987	0.57691	0.57395	0.57100	0.56805
570	0.56805	0.56511	0.56217	0.55924	0.55631	0.55338
580	0.55338	0.55047	0.54755	0.54464	0.54174	0.53884
590	0.53884	0.53594	0.53305	0.53016	0.52728	0.52440

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TABLE A.2 (Cont'd)

(N. I. A.)	Distance Ratio ($\sqrt{2}R/R_0$) = 1.414 214 (R/R_0)					
600	0.52440	0.52153	0.51866	0.51579	0.51293	0.51007
610	0.51007	0.50722	0.50437	0.50153	0.49869	0.49585
620	0.49585	0.59302	0.49019	0.48736	0.48454	0.48173
630	0.48173	0.47891	0.47610	0.47330	0.47050	0.46770
640	0.46770	0.46490	0.46211	0.45933	0.45654	0.45376
650	0.45376	0.45099	0.44821	0.44544	0.44268	0.43991
660	0.43991	0.43715	0.43440	0.43164	0.42889	0.42615
670	0.42615	0.42340	0.42066	0.41793	0.41246	0.41246
680	0.41246	0.40974	0.40701	0.40429	0.40157	0.39886
690	0.39886	0.39614	0.39343	0.39073	0.38802	0.38532
700	0.38532	0.38262	0.37993	0.37723	0.37454	0.37186
710	0.37186	0.36917	0.36649	0.36381	0.36113	0.35846
720	0.35846	0.35579	0.35312	0.35045	0.34779	0.34513
730	0.34513	0.34247	0.33981	0.33716	0.33450	0.33185
740	0.33185	0.32921	0.32656	0.32392	0.32128	0.31864
750	0.31864	0.31600	0.31337	0.31074	0.30811	0.30548
760	0.30548	0.30286	0.30023	0.29761	0.29449	0.29237
770	0.29237	0.28976	0.28715	0.28454	0.28193	0.27932
780	0.27932	0.27671	0.27411	0.27151	0.26891	0.26631
790	0.26631	0.26371	0.26112	0.25853	0.25594	0.25335
	00	02	04	06	08	10

TABLE A. 2 (Cont'd)

(N. I. A.)

Distance Ratio ($\sqrt{2}R/R_0$) = 1.414 214 (R/R_0)

800	0.25335	0.25076	0.24817	0.24559	0.24301	0.24043
810	0.24043	0.23785	0.23527	0.23269	0.23012	0.22754
820	0.22754	0.22497	0.22240	0.21983	0.21727	0.21470
830	0.21470	0.21214	0.20957	0.20701	0.20445	0.20189
840	0.20189	0.19934	0.19678	0.19422	0.19167	0.18912
850	0.18912	0.18657	0.18402	0.18147	0.17892	0.17637
860	0.17637	0.17383	0.17128	0.16874	0.16620	0.16366
870	0.16366	0.16112	0.15858	0.15604	0.15351	0.15097
880	0.15097	0.14843	0.14590	0.14337	0.14084	0.13830
890	0.13830	0.13577	0.13324	0.13072	0.12819	0.12566
900	0.12566	0.12314	0.12061	0.11809	0.11556	0.11304
910	0.11304	0.11052	0.10799	0.10547	0.10295	0.10043
920	0.10043	0.09791	0.09540	0.09288	0.09036	0.08784
930	0.08784	0.08533	0.08281	0.08030	0.07778	0.07527
940	0.07527	0.07276	0.07024	0.06773	0.06522	0.06271
950	0.06271	0.06020	0.05768	0.05517	0.05266	0.05015
960	0.05015	0.04764	0.04513	0.04263	0.04012	0.03761
970	0.03761	0.03510	0.03259	0.03008	0.02758	0.02507
980	0.02507	0.02256	0.02005	0.01755	0.01504	0.01253
990	0.01253	0.01003	0.00752	0.00501	0.00251	0.00000

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EXAMPLE #1

Question:

The range under consideration is 2 miles. Normal integral accessibility at the focus of a transportation system is 1000 units of integral accessibility, and the (N.I.A.)_r follows the erfc (r). At which distance (R/R₀) is the accessibility 762 units of normal integral accessibility?

From table, $\sqrt{2} (R/R_0) = 0.30286$. Thus, R₀ being 2 miles, the distance R = 0.42837 miles.

Answer:

There is normal integral accessibility of 762 units of integral accessibility at the distance of 0.428 miles from the focus.

EXAMPLE #2

Question:

The range R₀ under consideration is 100 miles. The normal integral accessibility at a shipping terminal is 120,000 units of integral accessibility and the (N.I.A.)_x follows the erfc (x). At what distance has the integral accessibility the value of 65,760 units?

$120,000 / 1000 = 120$; $65,760 / 120 = 548$; from tables, $\sqrt{2} (R/R_0) = 0.60076$. Therefore, distance R = 42.5 miles.

Answer:

There is a normal integral accessibility of 65,760 units of integral accessibility at the distance of 42.5 miles from the shipping terminal.

EXAMPLE #3

Question:

Range R₀ = 6 miles. Height of the peak of N.I.A. is 200 units at the centre. What is the N.I.A. at a distance of 1.50 miles?

$200 / 1000 = 0.2$; $(R/R_0) = 1.50 / 6.00 = 0.25$; $\sqrt{2} (R/R_0) = 0.3535$. From tables, N. I. A. = 724 times 0.2 = 144.8 units.

Answer:

The integral accessibility at the distance of 1.50 miles from the centre is 144.8 units of normal integral accessibility.

Employees per
Gross Acre Employees per
Square Mile Employees per
0.10 Square Mile

45	28,000	2,800
40	24,000	2,400
35	20,000	2,000
30	16,000	1,600
25	12,000	1,200
20	8,000	800
15	4,000	400
10	2,000	200
5		

EMPLOYEES PER
SQUARE MILE

300,000
250,000
200,000
150,000
100,000
50,000
0

CANADIAN WESTINGHOUSE

SLATER STEEL CO.

ST. JOSEPH'S HOSPITAL

FEDERAL BLDG.

PROFESSIONAL ARTS BLDG.

KING & JOHN

KING & JAMES

JAMES & YORK

GENERAL HOSPITAL

AMERICAN CAN CO.
OTIS ELEVATOR
STELCO

INTERNATIONAL HARVESTER

CANADIAN WESTINGHOUSE

BURLINGTON STEEL CO.
BROWN FOREST INDUSTRIES

STELCO

DOMINION GLASS CO.

HOOVER CO. LTD.

PROCTER & GAMBLE

DOMINION FOUNDRIES
NATIONAL STEEL CAN

FIRESTONE

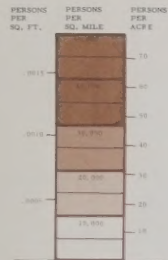
CANADIAN WESTINGHOUSE
UNITED GAS LTD.BROWN FOREST INDUSTRIES
ROBERTSON IRWIN LTD.ALLEN INDUSTRIES CANADA
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NIAGARA FOOD LTD.

BLACK CONTOURS: MANUFACTURING EMPLOYMENT DENSITIES
(ACCORDING TO 1968 INDUSTRIAL INDEX)

BLUE CONTOURS: C.B.D. EMPLOYMENT DISTRIBUTION
(ACCORDING TO 1961 FIELD SURVEY)



DISTRIBUTION OF MANUFACTURING AND CBD EMPLOYMENT



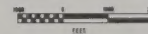
CONVERSION COLUMN



POINT AND CONTOUR VALUES OF POPULATION DENSITY ARE EXPRESSED IN TERMS OF PERSONS PER SQUARE MILE. THE BASE AREA OF CALCULATION IS IN EVERY CASE 1/10 OF A SQUARE MILE.

DEPT. OFFICIAL PLAN 1979 OF THE CITY OF HAMILTON

POPULATION DENSITY (1961 CENSUS DATA)



SPECIAL CREDITS

DRAFTING COVER E. Coloma, G. Dumbleton
KEY MAP G. Dumbleton
FIGURE 1.1 W. Chan, G. Dumbleton
FIGURE 1.2 N. Hostiuc, W. Chan
FIGURE 1.3 B. Klotz
SCHEDULE 1-P G. Dumbleton
SCHEDULE 1-Q G. Dumbleton
SCHEDULES 1-R1 to 1-R5 W. Chan
SCHEDULES 1-S1 to 1-S6 A. Passarelli,
G. Dumbleton, W. Chan
SCHEDULES 1-T1 to 1-T3 W. Chan
SCHEDULE 2-U G. Dumbleton
SCHEDULE 3-V G. Dumbleton
SCHEDULE 3-W G. Dumbleton
FIGURE A.1 W. Chan
FIGURE A.2 W. Chan
FIGURE A.3 G. Dumbleton
FIGURE A.4 G. Dumbleton
FIGURE A.5 W. Chan
FIGURE A.6 G. Dumbleton
POPULATION DENSITY A. Glazebrook
EMPLOYMENT DENSITY (DOWNTOWN AREA)
A. Marcolini, A. Passarelli
DISTRIB. OF MFTG. & C.B.D. EMPLOYMENT
S. Lau, W. Chan

TEXT LAY-OUT N. Hostiuc

TYPING D. Meeboer
Y. Buys



3 2022 21335673 2

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and Chairman of the Board of Control
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